VOLUME XLI NUMBER THREE

THE NATIONAL GEOGRAPHIC MAGAZINE

MARCH, 1922

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TO carry out the purposes for which it was founded thirty-four years ago, the National Geographic Society publishes this Magazine. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by an addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resultant given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over $50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their discoveries form a large share of our knowledge of a civilization which was waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the historic expedition of Admiral Peary, who discovered the North Pole.

NOT long ago The Society granted $25,000, and in addition $75,000 was given by individual members through The Society to the Federal Government when the congressional appropriation for the purchase was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people and incorporated into a National Park.

THE Society is conducting extensive explorations and excavations in northwestern New Mexico, which was one of the most densely populated areas in North America before Columbus came, a region where prehistoric peoples lived in vast communal dwellings whose ruins are ranked second to none of ancient times in point of architecture, and whose customs, ceremonies and name have been engulfed in an oblivion more complete than any other people who left traces comparable to theirs.

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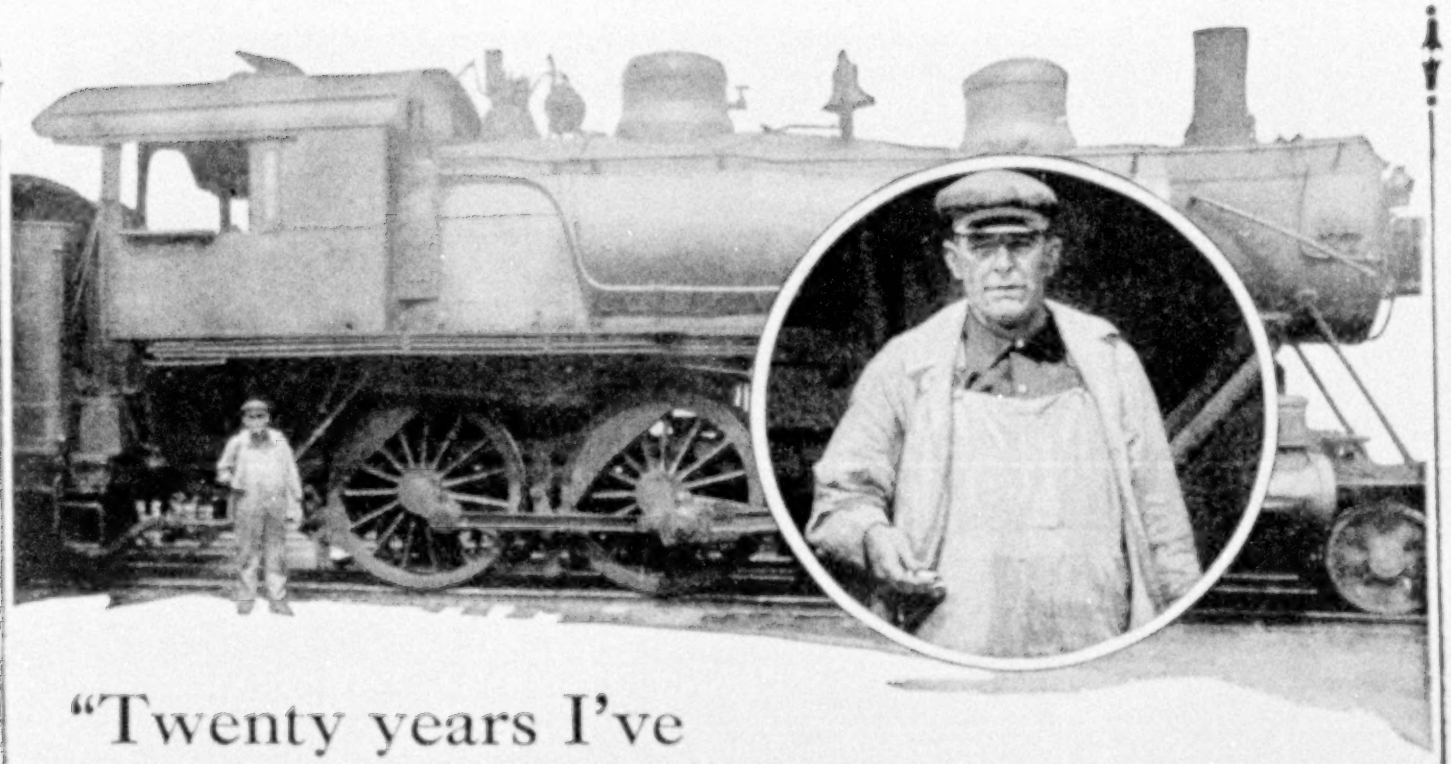

"Twenty years I've carried this watch"

ENGINEER Charles Monk of the Erie Railroad is proud of his Hamilton. Twenty year companions they've been, and the Hamilton has been a faithful, reliable comrade.

Even Engineer Monk wouldn't estimate the enormous number of trains he has brought in "on time." He does say that in the ordinary day's work he must consult his Hamilton dozens of times.

Dozens of times a day, multiplied by three hundred odd days a year and by twenty years—that would make a figure which in itself spells "service." Through it all, his Hamilton has given accurate time.

You may not be an engineer or a railroad man, but you have need for accurate time dozens of times a day. And besides the pride of ownership in a good, beautiful watch, there is the insistent demand of modern business upon every man's time, which makes an accurate watch an essential part of his equipment.

Get this "railroad accuracy." You can find in the Hamilton booklet, "The Timekeeper," the model and size that pleases you most. It shows ladies' beautiful wrist watches and thin models for men. All of them make worth-while and appreciated gifts. Write for a copy. It tells how to care for a fine watch.

Hamilton Watches range in price from $40 to $200; movements alone, $22 (in Canada, $25) and up.

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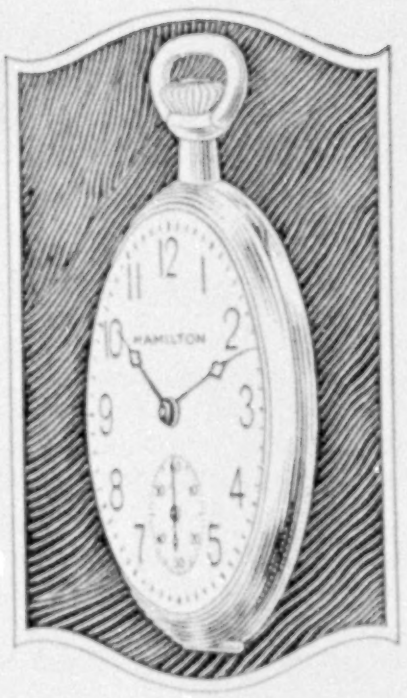
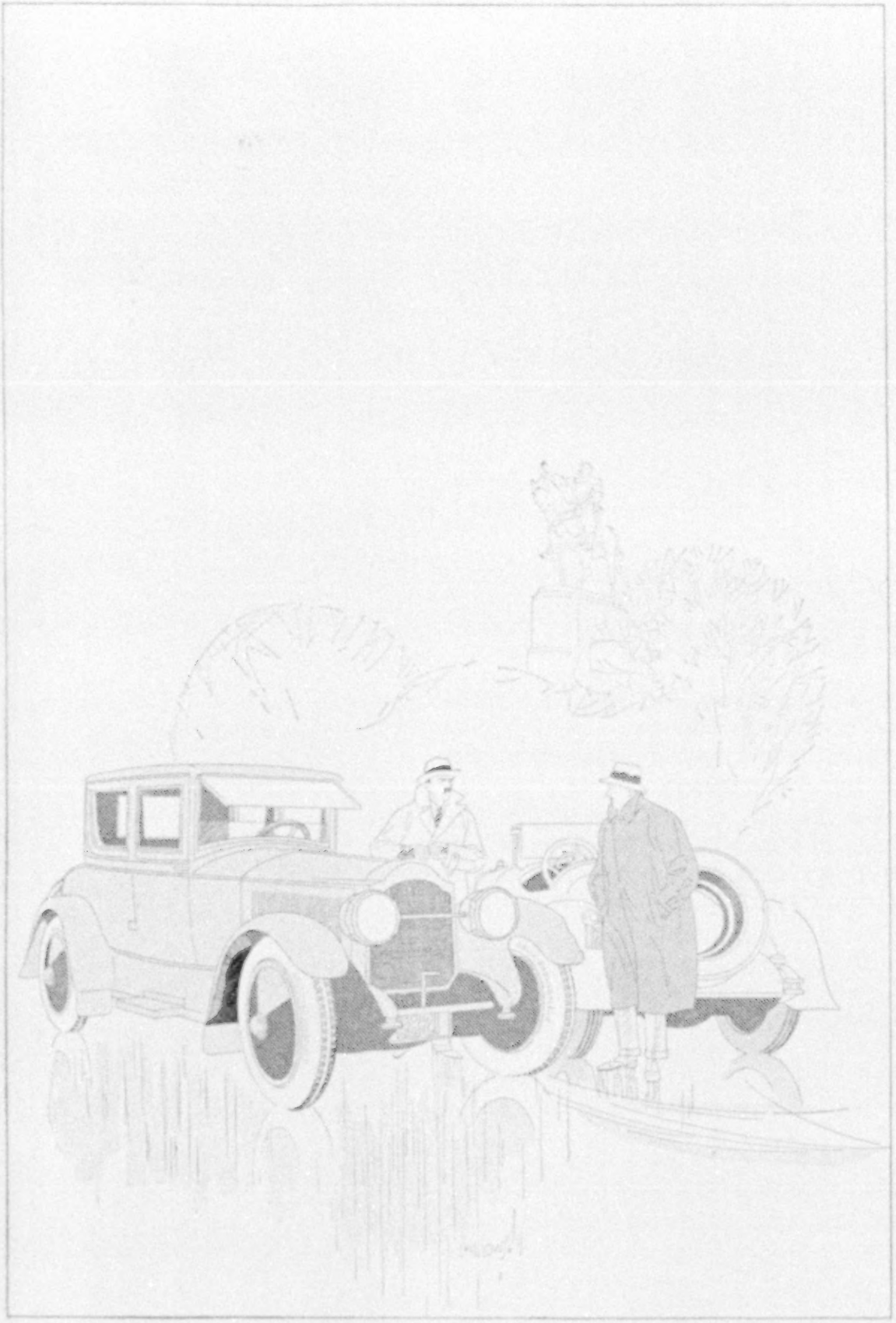
GIFTS THAT LAST

Everyman's watch—railroad accuracy with beauty of appearance. Write for descriptive booklet.



The Watch of Railroad Accuracy

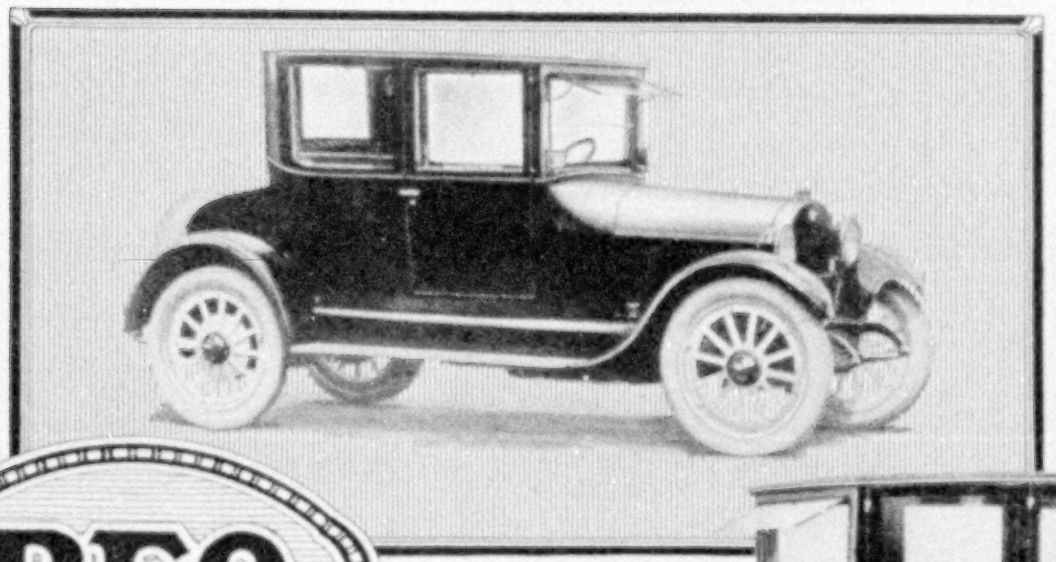
Hamilton Watch



The Bumper: Sorry, old man, but I couldn't possibly have prevented it.

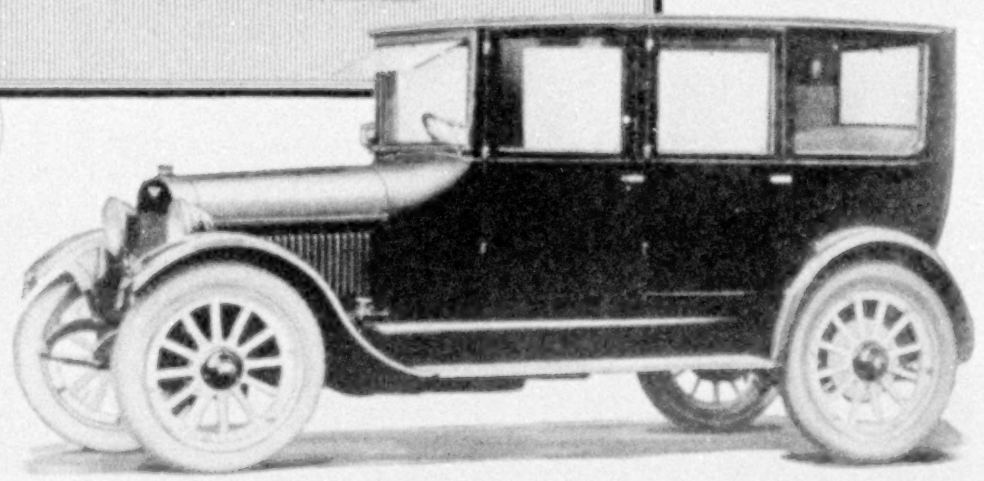
The Bumpee: Of course you could—you could have had Kelly-Springfield Kant-Slip Cords on your car; then you wouldn't have skidded.

THE element of safety is only one of the many advantages of the new Kelly Kant-Slip Cord. The same long, uninterrupted mileage that has always been a Kelly characteristic is maintained. Economies in manufacture and greatly increased production have, however, brought the price of Kellys down so that now *it costs no more to buy a Kelly.*



REO

Closed Cars



Beauty That is More Than Skin Deep

When admiring the new closed Reos—the four passenger Coupe and the new Sedan—which you will find outstandingly beautiful by comparison with other high class equipages, please remember that the beauty you see is more than skin deep.

Concealed excellence—beauty in unseen as well as visible places—is a Reo attribute.

If you will look not only at the surface, but beneath—and if you will insist upon knowing the materials that go into the making of the various closed cars shown you, you will find that few cars at anywhere near Reo prices have all-aluminum bodies.

And from the fullness of our long experience, we assure you no lesser material is adequate to the service and the satisfaction you expect when you select your car.

No other material will receive and maintain the finish—will resist rust—will be so free from "drumming" sounds—as aluminum.

And no body can be as good as a Reo body unless the construction be, as Reo bodies are, full aluminum.

If you will study this body question—insist first on the best materials and construction, and then compare prices, you will be more than ever surprised to learn that you may have a car that is the last word in quality and fine coach work, and yet at a price that is so much less than you had expected to pay.

Reo Motor Car Co., Lansing, Mich.

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XUM

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All homes depend largely upon their plumbing, sanitation and heating equipment for comfort, convenience, economy and value.

These important factors can be assured, and the installations made dependable and permanent in your home by obtaining the necessary materials complete through Crane Service.

By visiting the nearest Crane Branch, Exhibit Room or Office with your architect you can select from large assortments of styles and sizes *the entire equipment needed* for plumbing, sanitation, heating and allied systems—in the most advanced designs.

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We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures and all purposes, and are distributors through the trade of pipe, heating and plumbing materials.

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Not in years has a magazine series compelled wider interest than Elgin's historical art-cycle, "Through the Ages with Father Time." Last month's issue saw its climax in DeLay's mural panorama, "The Pageant of Time." The new series, "The Value of Time," is its logical and fascinating sequel.

Outgrowth of the ancient "Festival of Lights," the "Feast of Lanterns" is the world's most radiant festival.

The Value of Time

By Krónos

Paintings by
HAROLD DELAY

"GIVE IT TIME," said Confucius to an impatient disciple. "Every day cannot be a Festival of Lights."

Twenty-four centuries before the age which we fondly call modern! Yet the disciple of present-day Efficiency may find food for thought in the way the great Chinese philosopher planned out his daily life.

Confucius, in his wisdom, took Time to *save* Time.

His was a far-visioned schedule. "At fifteen," he wrote in his latter years, "I entered on a life of study. At thirty I took my stand as a scholar. At forty my opinions were fixed. At fifty I could judge and select. At sixty I never relapsed into a known fault. At seventy I could follow my heart's desires without going wrong." Confucius cherished the broad life-vision of which Li Po, China's greatest poet, sang thirteen centuries after—

"The universe is but a tenement
Of all things visible: Darkness and Day
The passing guests of Time!"

In timekeeping devices, as in so many other inventions, the Flowery Kingdom apparently anticipated other nations by thousands of years. Even our "modern" daylight-saving system was introduced by Duke Chan a trifle over three thousand years ago. He divided the floating index of the water-clock into one hundred *kih*, or parts. In winter he allotted forty *kih* to day and sixty to night. *In summer he reversed this.*

The tranquil, leisurely routine of the high-caste Chinese is a constant challenge to Americans, who see it as a deliberate waste of life's most costly commodity—*Time*. Yet the Chinese gentleman of today keeps watch repair shops working overtime by carrying *two* watches, which he is anxious shall run harmoniously!

A quaint procedure, eloquent of the Orient's real appreciation of *the value of Time*, but happily unnecessary among the fortunate owners of America's timekeeping masterpieces—

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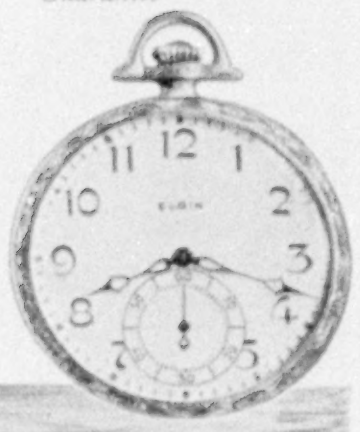

Elgin Watches

MADE IN ELGIN, U. S. A.

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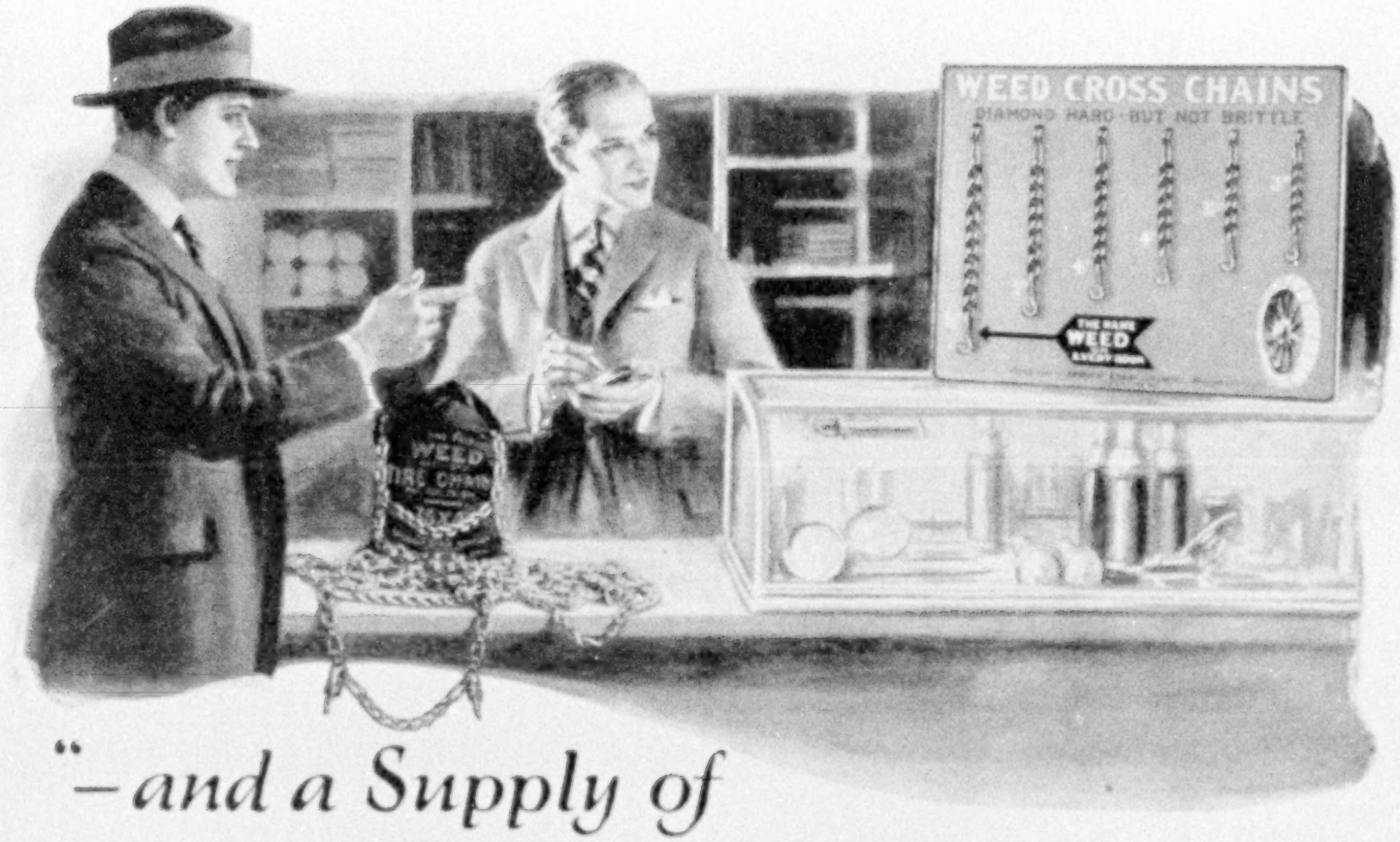
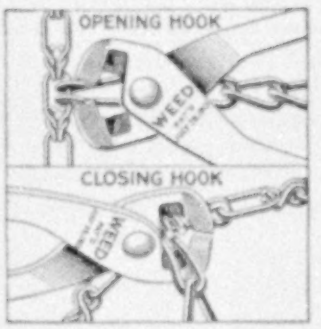


"—and a Supply of WEED CROSS CHAINS

"Yes, I want a new pair of WEEDS for my front tires and Weed Cross Chains to retread my old rear tire chains. You see at this time of the year it's best to chain all four wheels to the road."

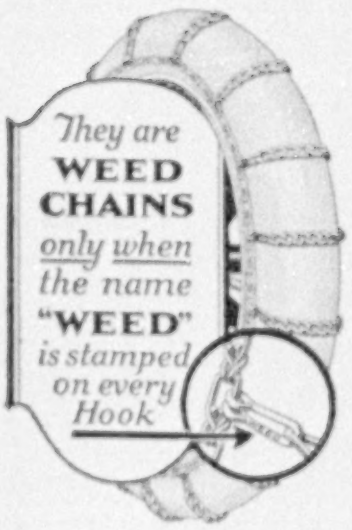
Weed Cross Chains are hard but not brittle, the links are cold twisted in automatic machines to present a smooth surface to the tire and then "treated" to give just that degree of hardness which insures long wear without sacrificing strength. The surface hardness which graduates to the tough elastic core, enables the Weed Cross Chains to withstand both friction and shock.

Weed Cross Chains have been made for Weed Tire Chains since 1903, and today they are the best Cross Chains that human knowledge and skill can produce. *If a better Cross Chain can be made it will be a "WEED".*



The Weed Pliers are sold with Weed Cross Chains and make retreading very simple.

Weed Cross Chains are sold everywhere by auto accessory dealers, hardware stores and garages



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How Firestone Has Reduced the Cost of Tire Service

Size	Jan. 1921 Prices	Jan. 1922 Prices	Reduction
30 x 3½ Cord	$35.75	$17.50	51%
32 x 4 Cord	56.55	32.40	43%
33 x 4½ Cord	67.00	42.85	36%
33 x 5 Cord	81.50	52.15	36%
30 x 3 Fabric	18.75	9.85	47%
30 x 3½ Fabric	22.50	11.65	48%

HOW the cost of building quality tires has been brought down to the lowest level in history was explained by H. S. Firestone, President of the Company, to the stockholders at the annual meeting on December 15, 1921:

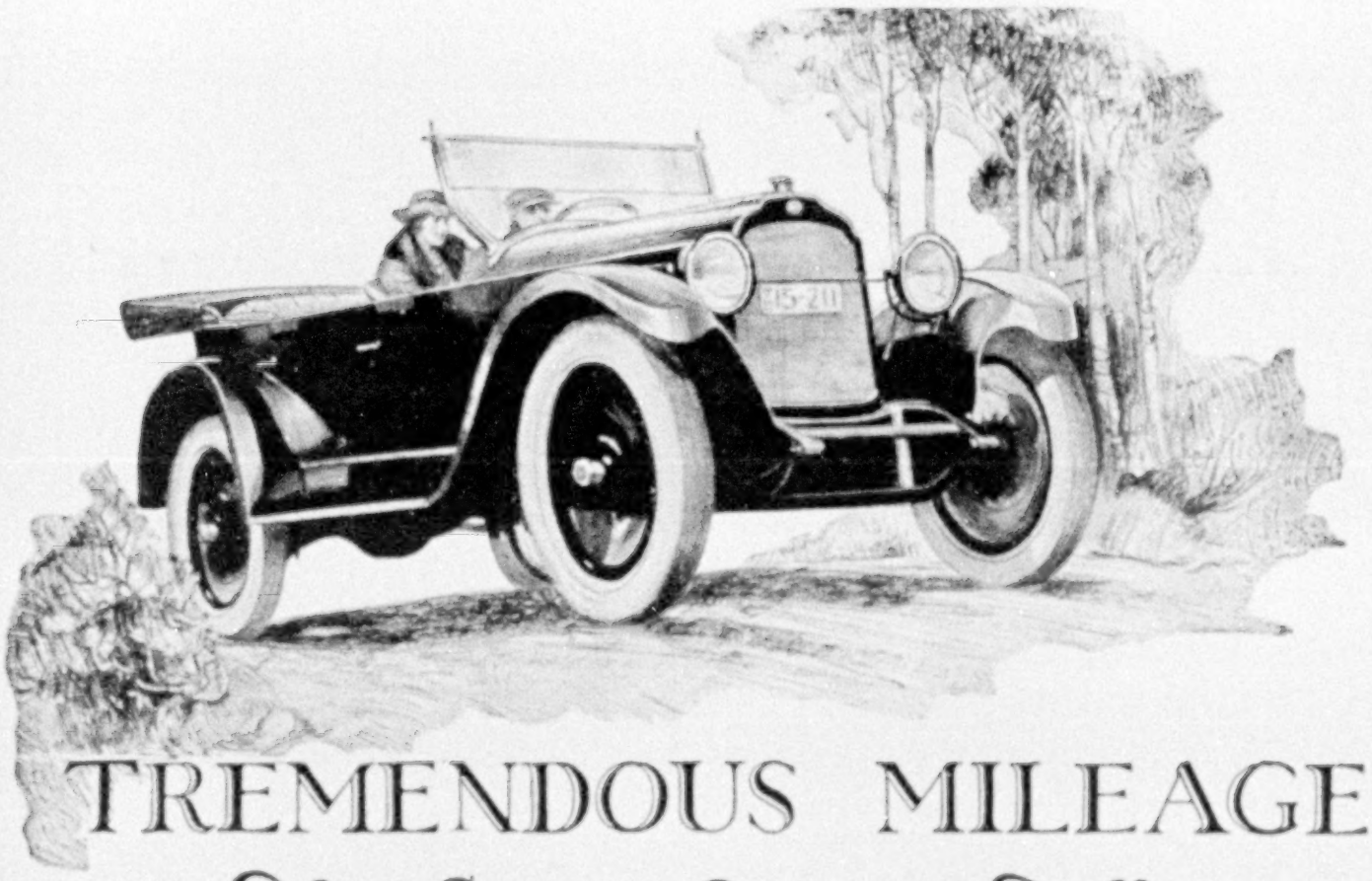
1. *All inventories and commitments at or below the market.*
2. *Increased manufacturing efficiency and volume production reduced factory overhead 58%.*
3. *Selling costs reduced 38%.*

Mr. Firestone stated, "This accomplishment is made possible by our unusually advantageous buying facilities, and the enthusiasm, loyalty and determination of our 100% stockholding organization.

"Due credit must be given to Firestone dealers who are selling Firestone tires on a smaller margin of profit. This brings every Firestone saving direct to the car-owner."

Most Miles *per* Dollar

Firestone



TREMENDOUS MILEAGE

The Story Owners Tell

Owners cling to their Willys-Knight car for years with an enthusiasm that is almost affection. They prefer it to any other car at any price. They attain tremendous mileage with great economy, unhampered by motor adjustments.

A Buffalo manufacturer writes: "After some 75,000 miles of running, the engine and body are apparently in as good condition as when the car was bought."

A garage mechanic from Walnut, Illinois: "I have driven my Willys-Knight over one hundred thousand miles, and will say that I have certainly had good service."

A jeweler from Fort Dodge, Iowa: "The engine has not been touched in four seasons. Oil and water consumption is almost negligible."

The Willys-Knight Sleeve-Valve Motor eliminates cams, springs, and tappets. Fewer parts and simpler operation give freedom from adjustments. It puts an end to valve troubles. It *stays* quiet and *is always ready for service.*

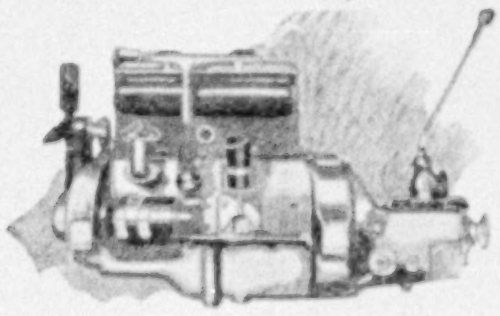
In every detail the Willys-Knight is a car of distinction—in appearance, comfort, economy, and long life. It brings luxurious motoring within nearly everybody's reach.

WILLYS-OVERLAND, INC., TOLEDO, OHIO

CANADIAN FACTORY, WILLYS-OVERLAND, LTD., WEST TORONTO, CAN.

WILLYS-KNIGHT

Sleeve Valve Motor Improves With Use



North Cape Cruise

Don't you want to go?

—to cruise luxuriously on a privately chartered liner, through the long days and evenings of early summer?

—to sail northward and eastward, retracing the voyages of the hardy Norsemen—till you cross the Arctic Circle and the sun at Midnight hangs like a ball of fire above the horizon?

—to visit Iceland—the Viking island—to see the great North Cape rising sheer from the water, and to climb the winding path to its broad flat summit?

—to sail in and out of the beautiful fjords that fringe like deep-cut lace the coast of Norway?

Come on the Raymond-Whitcomb North Cape Cruise

Sailing from New York, June 28 on the S.S. "Osterley" (19,000 tons displacement). The route includes Iceland, the North Cape, the Norwegian Fjords, Bergen and Christiania, Helsingborg in Sweden, Copenhagen, Belgium and England. Shore excursions at the ports of call. Special Extension Tours in Europe. Rates $675 and upward.

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Comprehensive and carefully planned tours with new and seasonable features —among them Italy, Southern France and Switzerland. Two unusual Spring Tours of Spain—March 15 and April 22. Motor trips in the British Isles. Special itineraries including the "Passion Play" at Oberammergau.

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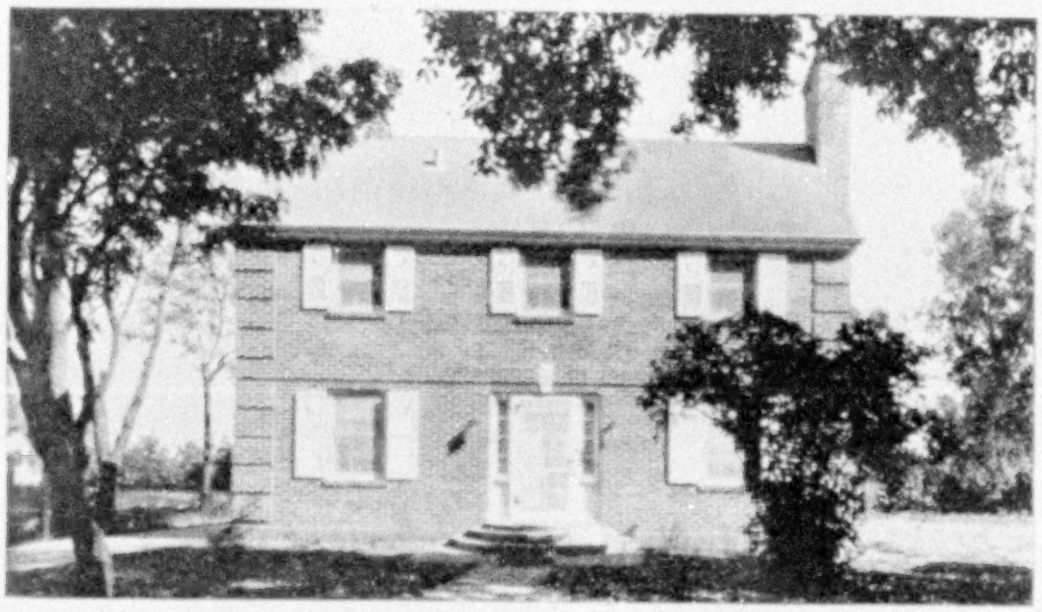

HOME OF BEAUTY HOUSE NO. 101

The three views above show Home of Beauty House No. 101, built by Mr. Leslie Welter at Moorehead, Minn. Mr. Welter says: "We are very well pleased with our building experience. A leading architect of Fargo, N. D., said that this house is the best designed and best looking house of any he has seen in this section of the country. Our house created such a favorable impression that several houses have been built of brick in this vicinity this season. I wish to thank you for the excellent service you rendered me at a cost that was practically negligible."

BETTER HOMES

AS THE MANY advantages of the Face Brick house—its supreme beauty, its unmatched durability, its safety from fire and its marked economies—should be available to the average home-builder, to whom the architect is not accessible, the American Face Brick Association has issued various designs for small Face Brick houses, ranging in size from three to eight rooms.

During the last year and a half nearly 100,000 of these plan booklets have been sent out on request and the designs have received enthusiastic endorsement from home-builders in all parts of the country.

"The Home of Beauty" shows fifty houses, mostly two stories, designed by architects in all parts of the country for a national competition. They represent a wide variety of architectural designs and carefully planned interior arrangements. Sent for 50 cents. We have complete working drawings, specifications and quantity estimates for these houses at nominal cost.

"Face Brick Bungalow and Small House Plans" are issued in four booklets, showing 3 to 4-room houses, 5-room houses, 6-room houses, and 7 to 8-room houses, in all ninety-two, each reversible with a different exterior design. These designs are unusual and distinctive, combined with convenient interiors and economical construction. The entire set for one dollar. Any one of the booklets, 25 cents.

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"The Story of Brick" is an artistic booklet with numerous illustrations and much valuable information for all who intend to build. It discusses in detail the many advantages and economies of the Face Brick house. Sent free.

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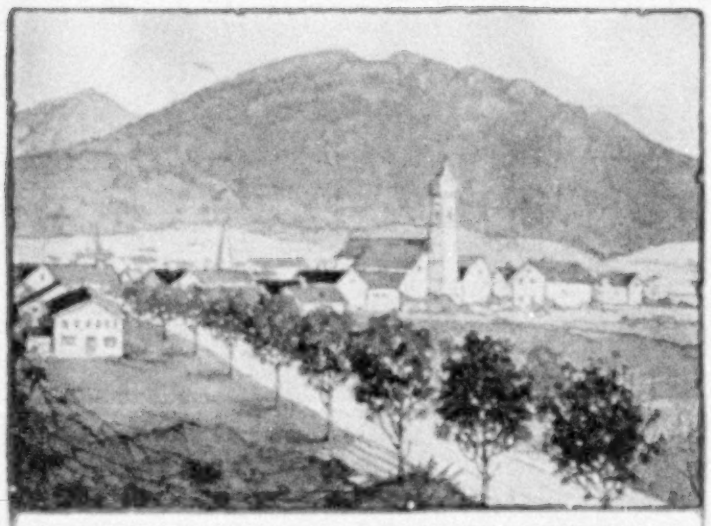

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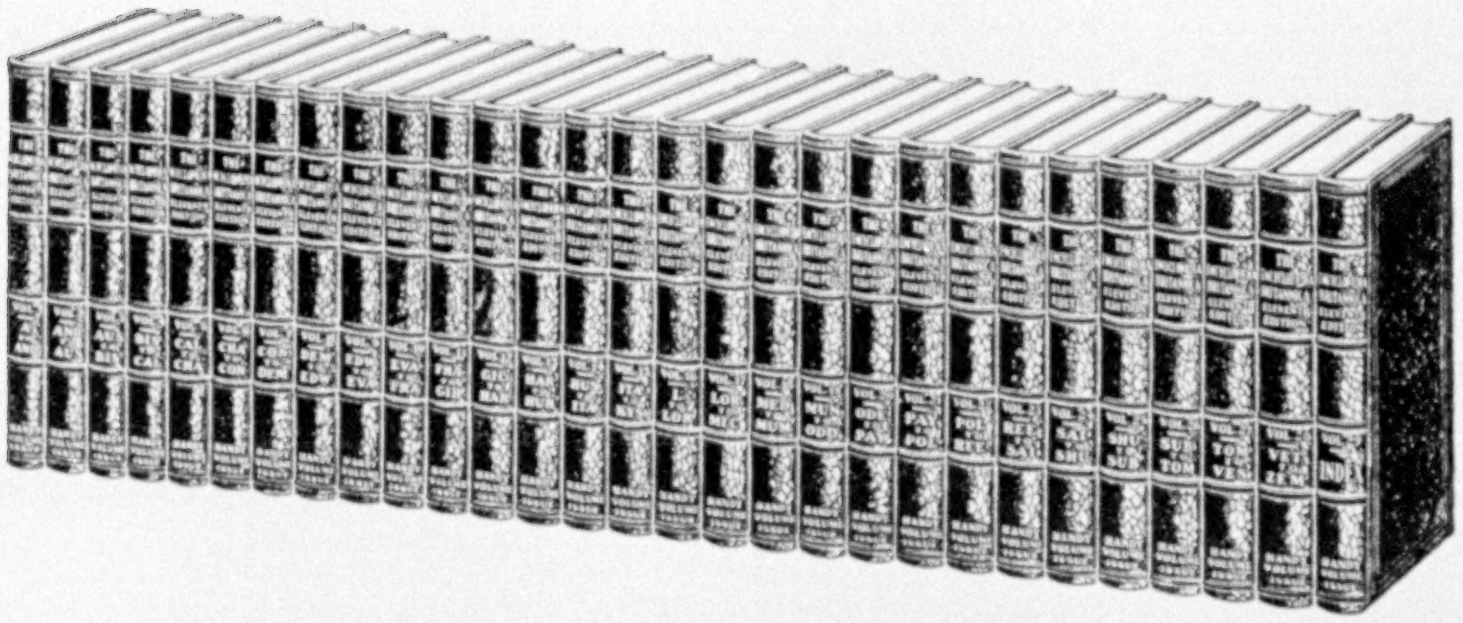

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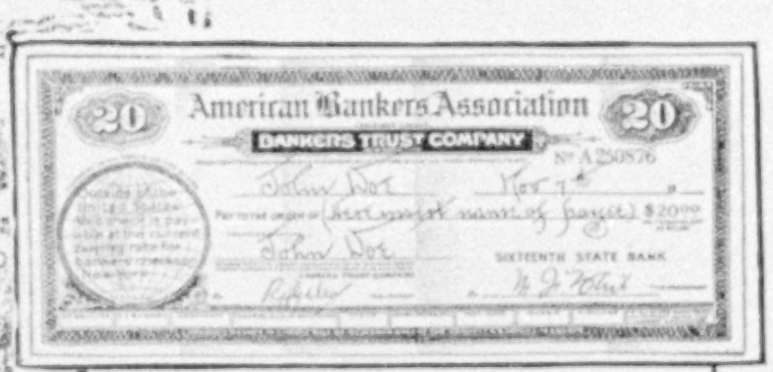

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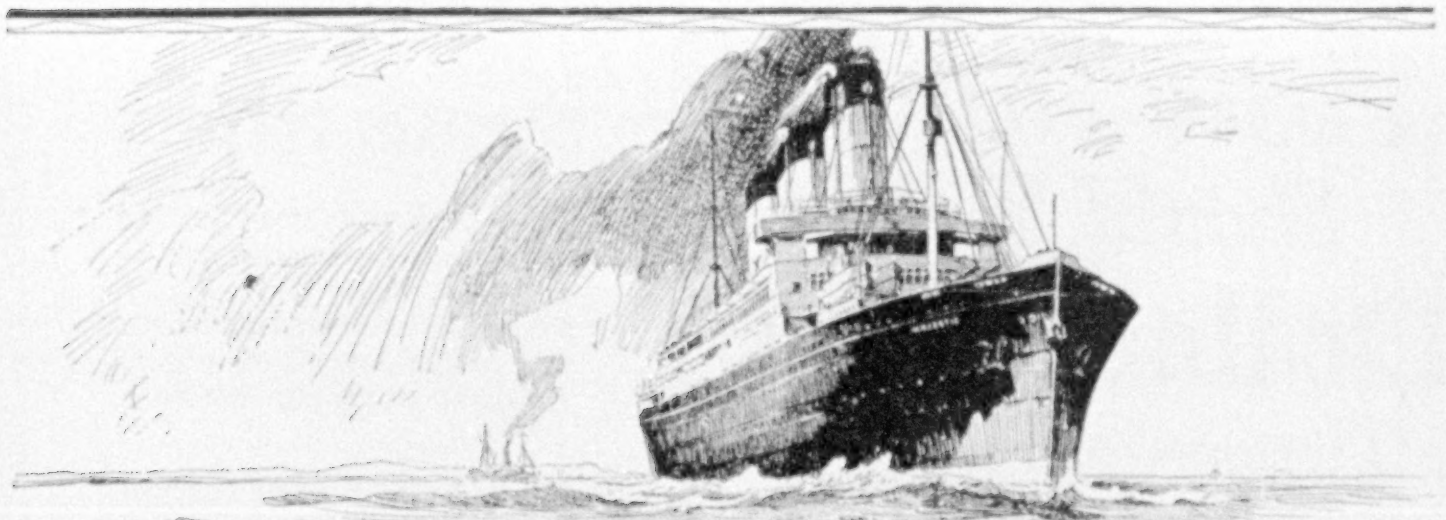

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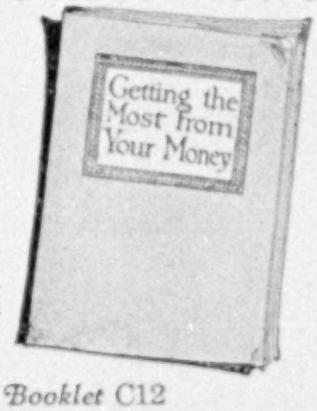

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VOL. XLI, No. 3 WASHINGTON MARCH, 1922

THE NATIONAL GEOGRAPHIC MAGAZINE

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PREHISTORIC TELEPHONE DAYS*

By Alexander Graham Bell

Author of "Discovery and Invention," "A Few Thoughts Concerning Eugenics," "Prizes for the Inventor," "Who Shall Inherit Long Life," etc., in the National Geographic Magazine

I WAS over in England the other day and was rather startled and amused by some of the greetings I received while there. Upon one occasion I was introduced to a lady as "the inventor of the telephone," and what do you think she replied? "Well, Mr. Bell," she said, *"I thought you were dead long ago"!*

Well, I am not dead yet; and I can assure you that it gives me great pleasure to be able to be with you today and meet the Commissioner and the ladies and gentlemen connected with the Patent Office.

I have been thinking a good deal about what I could say to you here. Of course, you expect me to say something about the telephone, but I rather think that you know more about the telephone today than I do.

When I heard the Commissioner remark that there had been more than 8,000 patents granted in the telephonic department, and thought of the multitude of interferences that must have arisen, and the thorough way in which you must have examined into the past history of the art, I came to the conclusion that there was not much use in my telling the examiners of the Patent Office anything about the history of the telephone; you are familiar with it already.

My only hope of telling you anything you don't know is to give you a few personal reminiscences concerning what we might term "Prehistoric Telephone Days." Here I have a clear field to myself, for there are certainly few, if any, persons now living who are competent to speak of my boyhood and the various influences, hereditary and environmental, that molded my early life and led me onward irresistibly in the direction of the telephone.

Here I am afraid I will have to go back to my grandfather, Alexander Bell of London, England (1790-1865).

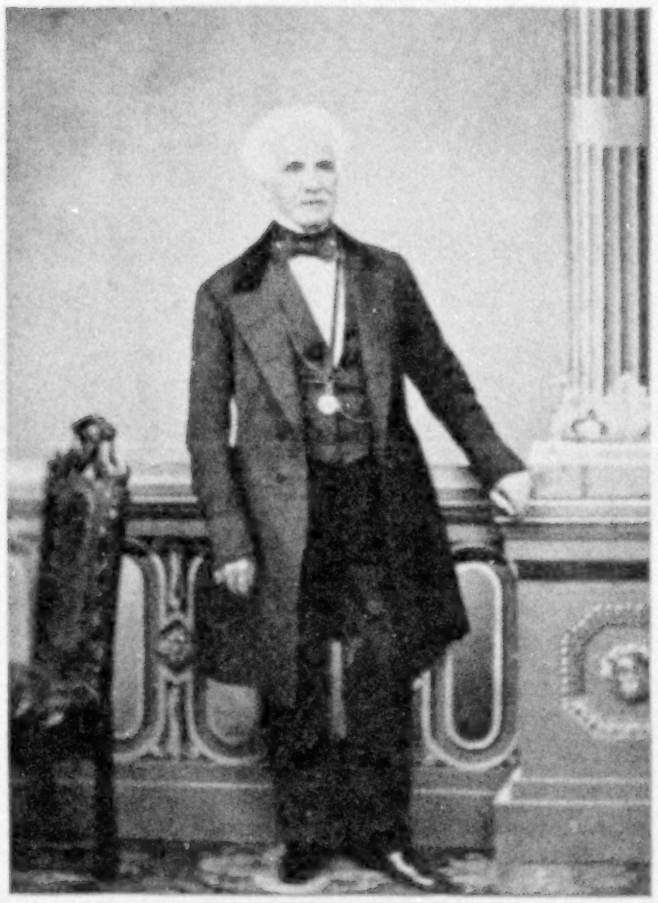
He was an elocutionist and a corrector of defective utterance. He was the first in the family to take up the study of the mechanism of speech with the object of correcting defects of speech by explaining to his pupils the correct positions of the vocal organs in uttering the sounds that were defective.

EARLY EDUCATION

My early boyhood was spent in Edinburgh, but when nearly fifteen years of age I went to London and stayed for a year with my grandfather. I had there no young companions of my own age, and this year spent alone with an old man had a profound influence upon my whole future life.

My grandfather took a great deal of interest in my education. My school life had been characterized by great indifference to the usual school studies and I took a very low rank in my classes. The

*An address before the officials and examining force of the U. S. Patent Office. Revised from the stenographer's notes and largely rewritten for publication in the National Geographic Magazine.—A. G. B.



ALEXANDER BELL OF LONDON

Elocutionist and corrector of defective utterance, who exerted a profound influence on his grandson, Alexander Graham Bell.

Photograph by Edinburgh Society

ALEXANDER GRAHAM BELL AT TWENTY

From early childhood the inventor of the telephone evinced a great interest in the study of sound and the art of speech.

ALEXANDER MELVILLE BELL IN 1868

The father of Alexander Graham Bell, who devised a universal alphabet for recording the sounds of all languages (see page 228).

Photograph by the Parisian Studio

MRS. ALEXANDER MELVILLE BELL

The mother of Alexander Graham Bell, whose paintings reflected an artistic nature which was transmitted to her son as a gift for music.

subjects in which I really excelled, such as music, botany, and natural history, formed no part of the school curriculum. For Latin and Greek I felt no taste. Geography, too, I found dry and uninteresting.

In arithmetic alone I think I took an average stand. My knowledge of the processes of arithmetic was fairly good, but I failed sadly in the execution. In exercises in proportion, for example, I found little difficulty in stating the proportion correctly, but could rarely work out the correct answer, on account of the mistakes in addition, subtraction, multiplication, and division.

My poor standing in school was, I think, the result of lack of ambition rather than of real lack of ability, for I excelled in the unusual studies I pursued out of school hours and in which I took a real interest.

"MUSIC WAS MY EARLIEST HOBBY"

MUSIC WAS AN EARLY PASSION

Music especially was my earliest hobby. I learned to play the piano at such an early age that I have no recollection now of a time when I could *not* play. I seem to have picked it up by myself without any special instruction, and although I knew nothing of written music, I could play anything I heard by ear and could improvise at the piano for any length of time.

Of course, it is difficult for me now to form any true estimate as to what my real abilities were in this direction as a little child, but some circumstances seem to indicate that they must have been exceptional.

A distinguished professor of music, Signor Auguste Benoit Bertini, heard me improvising at the piano, and when he found that I had received no instruction in music and knew nothing of notes, he adopted me as a musical protégé. For some months he gave me instruction in his system of reading music at sight.

He was then an old man and did not live long. I have a faint recollection of my last interview with him, when he presented me with everything necessary to teach his system of music and expressed the hope that when I grew up to be a man I would not let him be forgotten. After his death I received no further formal instruction in music excepting from my mother, who sought to carry out Bertini's ideas as well as she could.

It is rather a curious fact that the moment I learned to read music from notes I gradually lost the faculty of playing by ear.

The promise of my early childhood in the musical direction did not materialize, and although during the whole of my boyhood my great ambition was to become a musician, I gave up music when I entered upon the work of teaching the deaf.

I am inclined to think, however, that my early passion for music had a good deal to do in preparing me for the scientific study of sound.

NATURE STUDY

As a child, I took a great deal of interest in flowers and plants and formed a large herbarium, arranged according to the Linnean system of botany.

I am inclined to think now that I must have had assistance, probably from my father, in studying botany. It is very unlikely that a little child could take it up by himself. My collection of plants gradually gave way to collections of shells and birds' eggs. Then came butterflies and beeties and finally the skeletons of small animals, like frogs and toads, mice and rats.

On one occasion my father presented me with a dead sucking pig, and the "distinguished professor of anatomy" was

ALEXANDER GRAHAM BELL AT THE AGE OF FIFTEEN

From an old photograph taken at his father's country home in the suburbs of Edinburgh.

called upon for a lecture. So a special meeting of "The Society for the Promotion of Fine Arts among Boys" was held in my study, the attic of my father's house (13 South Charlotte Street, Edinburgh). This was sacred to me, and there my collections presented an imposing array of anatomical specimens.

Some boards were arranged as seats for the members of the society. On a table in the middle lay the defunct sucking pig. It was a great moment when I started to thrust my knife into the abdomen of the subject for dissection. But, unfortunately, there happened to be some air in the creature, so that the knife thrust was followed by a rumbling sound that resembled a groan, with the result that we thought the creature alive.

Horror-stricken, I rushed from the room, followed by all the boys. We tumbled over one another in our eagerness to get downstairs. Each boy fled to his home, and none returned to hear the lecture. Even the lecturer himself was too frightened to revisit the lecture-hall. My father was obliged to go upstairs and take charge of the corpse; I never saw it again.

Urged by curiosity, I was very fond of opening the bodies of small animals to see what they were like inside. I had a large collection of little skeletons, nicely arranged and classified as in a museum. I also had a good collection of the skulls of the "higher mammalia" (squirrels and rabbits), even including the heads of "carnivora" (cats and dogs); but the gem of the whole collection was a real human skull, presented to me by my father.

I can see in these natural-history collections a preparation for scientific work. The collection of material involved the close observation of the likenesses and differences of objects of very similar kind, and the orderly arrangement, as in a museum, stimulated the formation of generalizations of various kinds.

My father encouraged me in making collections of all sorts and in arranging the specimens in accordance with my own ideas rather than in conformity with the ideas of others. I am inclined to think that the making of these collections formed an important part of my educa-

tion and was responsible for my early bent toward scientific pursuits.

LIFE WITH MY GRANDFATHER

However much I may have excelled in these exceptional pursuits, my grandfather made me speedily realize that I was grossly ignorant of the ordinary subjects of study that every school-boy should know. He made me ashamed of this ignorance and aroused in me the ambition to remedy my defects of education by personal study. He helped me to map out my time and devote certain hours to the ordinary school subjects. He also gave me personal lessons in elocution and English literature.

My grandfather was well known as a Shakespearean scholar and a public reader of Shakespeare's plays; so, of course, I had to make myself familiar with the plays of Shakespeare and commit to memory long passages from "Hamlet," "Macbeth," "Julius Cæsar," and "The Merchant of Venice."

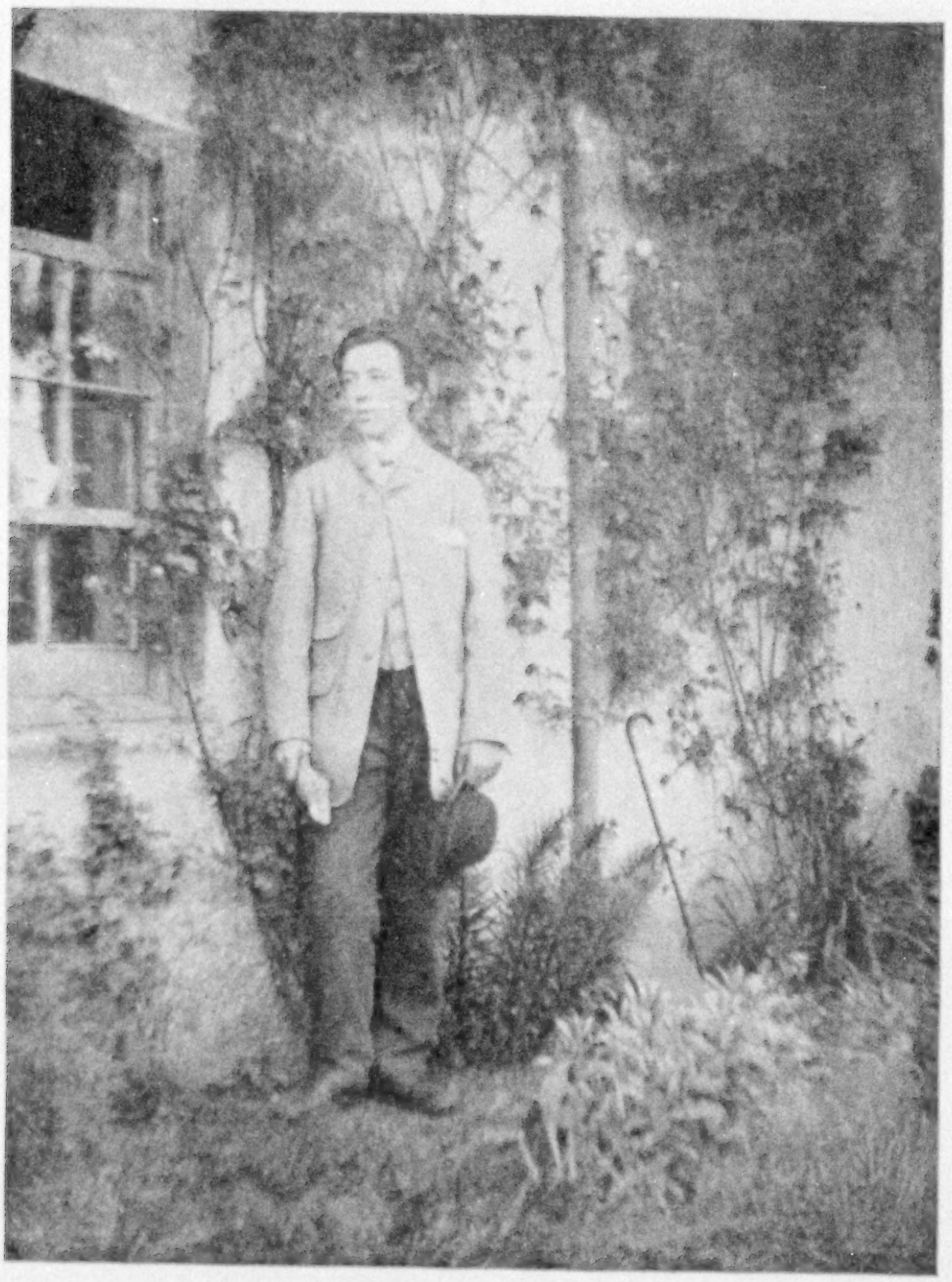
He also gave me instruction in the mechanism of speech and permitted me to be present at the instruction of some of his pupils, so that I might observe for myself his methods of correcting defective utterance.

This year with my grandfather converted me from an ignorant and careless boy into a rather studious youth, anxious to improve his educational standing by his own exertions and fit himself for college.

I have found it necessary to allude to my grandfather, and to his work in correcting defective utterance, not only on account of the influence he exerted upon my own life, but because the profession he founded became in process of time a family profession, which was handed down to his children and grandchildren. His two sons, for example, followed it.

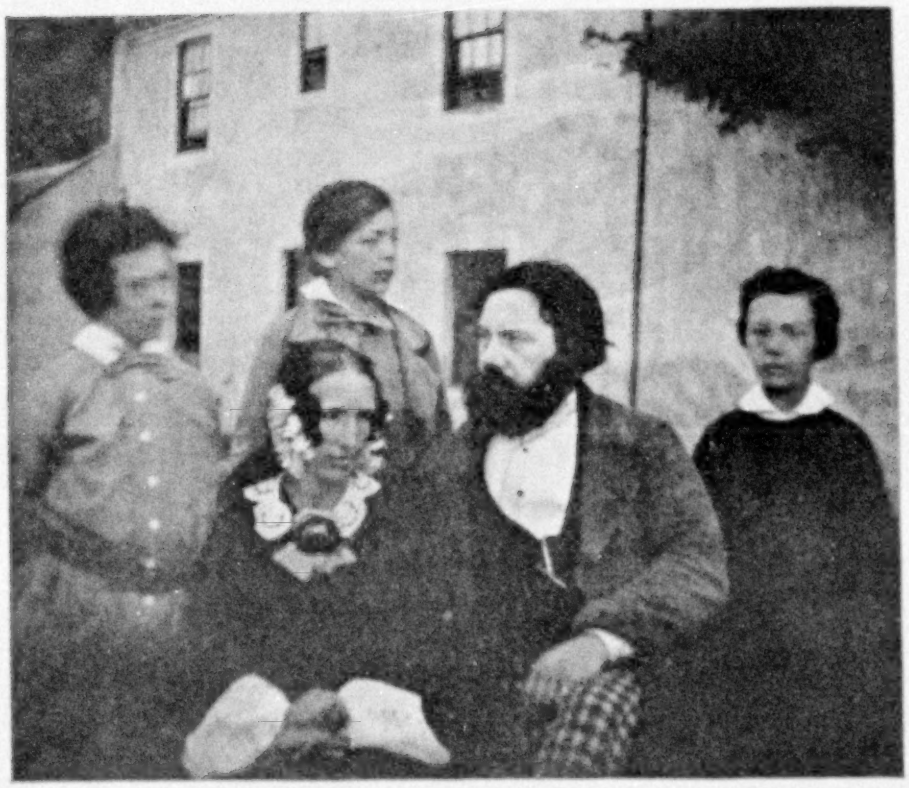
His oldest son, David Charles Bell, of Dublin, Ireland (1817-1902), was an elocutionist and corrector of defective utterance. He was the father, by the way, of Mr. Charles J. Bell, of Washington, President of the American Security & Trust Co.

His other son, my father, Alexander Melville Bell, of Edinburgh, Scotland (1819-1905), was also an elocutionist and



MELVILLE BELL (BROTHER OF ALEXANDER GRAHAM BELL)

Colaborer in the construction of the automaton speaking-machine and joint trainer of the "talking dog" (see text, pages 235-239).



ALEXANDER GRAHAM BELL'S FATHER, MOTHER, HIMSELF (ON THE LEFT), AND TWO BROTHERS, MELVILLE AND EDWARD, WHO DIED IN YOUNG MANHOOD

corrector of defective utterance. He, however, branched off in a new direction, as an inventor. He devised a remarkable system of symbols for depicting the actions of the vocal organs in uttering sounds. These symbols could be used in printed form, like letters of the alphabet. He claimed, indeed, that what he had really invented was a universal alphabet, capable of expressing the sounds of all languages in a single alphabet, and that his letters, instead of being arbitrary characters, were symbolic representations of the organs of speech and of the way in which they were put together in uttering sounds.

THE MELVILLE BELL SYMBOLS

For example, let me give you an illustration. The symbol for what we would call the letter M consisted of a curve forming the outline of a human lip, combined with another symbol meaning that the two lips were shut together. Then there was a third symbol, indicating the vibration of the vocal chords in forming voice; and still a fourth, showing that the soft palate was depressed so as to open the entrance into the nasal passages.

These four symbols were combined into a single character reminding one of some strange letter in a foreign language; but, unlike any such letter, it was not necessary for you to hear the sound in order to reproduce it.

The symbol could be analyzed into a direction to do something with the mouth, and if you followed the direction you uttered the sound, even though you had never heard it before.

The symbol for M could thus be translated into a direction to "shut your lips and pass voice through the nose." Now you will see, if you shut your lips and pass voice through the nose, you get one sound only, the sound of the letter M.

I remember my father giving a public lecture upon his system of Universal Alphabetics when I was a boy, and I acted as his assistant upon the occasion.

I was sent out of the hall, and then the members of the audience were invited to make any sorts of sound they desired, to be symbolized by my father. It was just as easy for him to spell the sound of a cough, or a sneeze, or a click to a horse, as a sound that formed an element of human speech.

Volunteers were called to the platform, where they uttered the most weird and uncanny noises, while my father studied their mouths and attempted to express in symbols the actions of the vocal organs he had observed.

I was then called in, and the symbols were presented to me to interpret; and I could read in each symbol a direction to do something with my mouth.

I remember upon one occasion the attempt to follow directions resulted in a curious rasping noise that was utterly unintelligible to me. The audience, however, at once responded with loud applause. They recognized it as an imitation of the noise of sawing wood, which had been given by an amateur ventriloquist as a test.

I remember another still more remarkable test. My father handed me a piece of paper with a very simple-looking sym-

bol upon it, and I was requested to utter the sound represented.

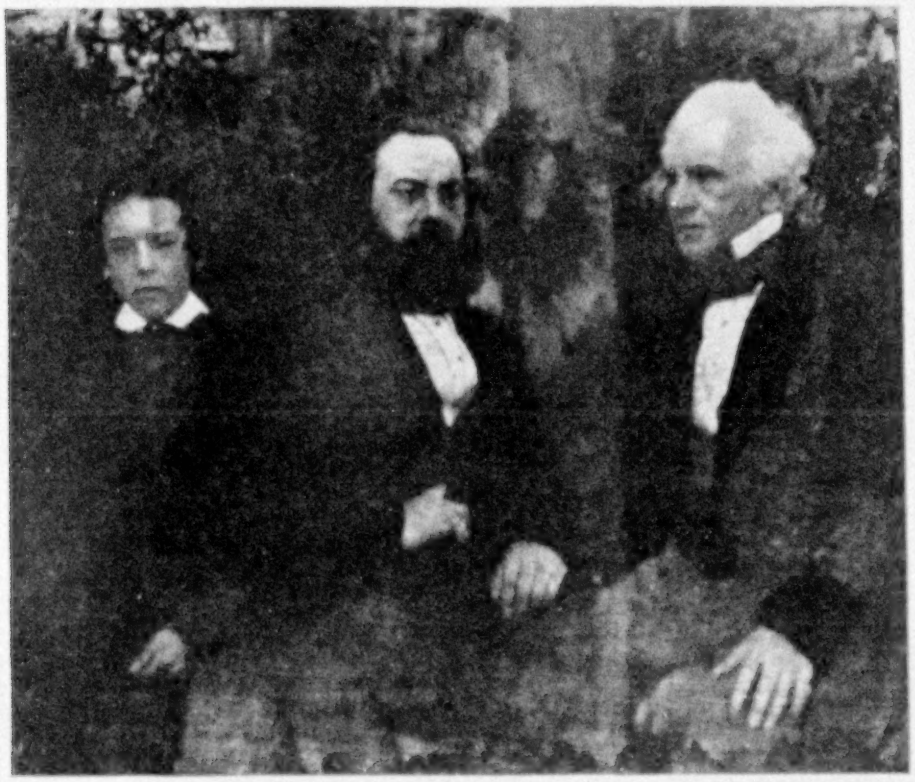
At first I thought it was simply the direction to pronounce the letter T, but soon noted a little diacritical mark attached to the symbol that had the technical meaning of "soft palate."

This I translated to mean that the point of the tongue, instead of being applied to the upper gum, as in the ordinary method of forming T, was to be coiled back in the mouth and placed against the soft palate—a thing I had never heard of or dreamed about before.

I followed the direction, coiled my tongue backward, and tried to make a T-sound, with the point of the tongue against the soft palate. This resulted in a sound resembling both K and T, and the gentleman who had given the test expressed great satisfaction. He informed the audience that he was a professor of Hindustani, employed by the Indian Civil Service to teach young men Sanskrit and the languages of India. The sound he had given was the "Sanskrit cerebral T." He had been very unsuccessful, he said, in getting English students to master this sound and expressed surprise that Mr. Bell's son should have given it correctly at the very first trial, *without ever having heard the sound at all.*

Such incidents as these led my father to predict that persons who were born deaf might, through the use of his symbols, be taught to use their vocal organs and speak, instead of being limited in their means of communication to gestures, finger-spelling, or writing.

This was first tried in a private school for deaf children near London, conducted by Miss Susanna Hull, the great pioneer of oral teaching in England (who is still living). I went to Miss Hull's school to assist her in making the experiment, and was thus introduced to what proved to be my life-work—the teaching of speech to the deaf.

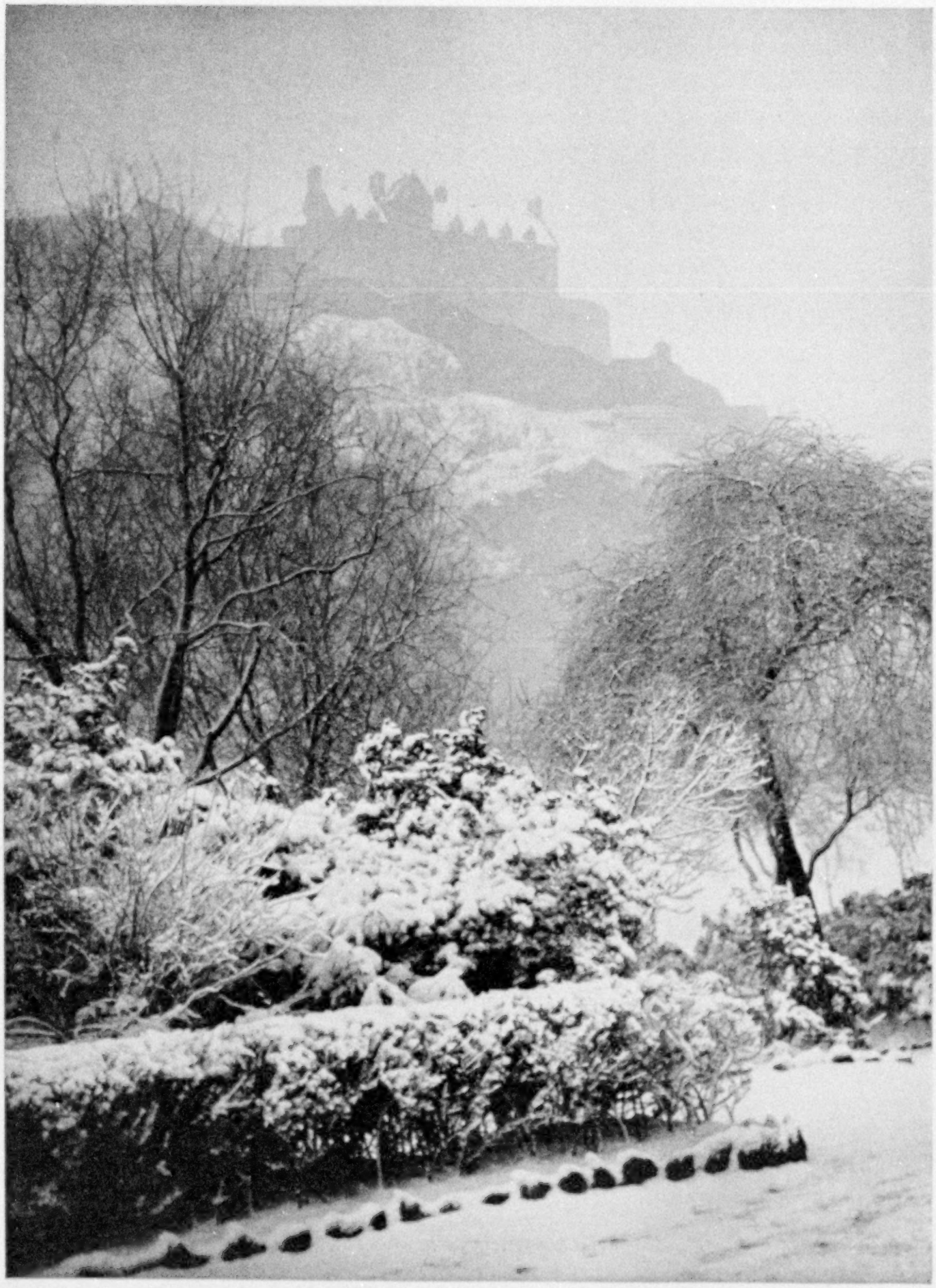


THREE GENERATIONS: ALEXANDER GRAHAM BELL ON THE LEFT, ALEXANDER MELVILLE BELL IN THE CENTER, AND ALEXANDER BELL ON RIGHT

In connection with this work I took up the study of the nature of the vibrations going on in the air during the utterance of speech with the object of developing an apparatus that would enable my deaf pupils to see and recognize the forms of vibration characteristic of the various elements of speech. Various instruments were devised employing loaded stretched membranes, all based upon the well-known phonautograph of Leon Scott; and these experiments paved the way for the appearance of the first membrane telephone, the ancestor of all the telephones of today.

It will thus be seen that the work of my father had a great and important influence in fitting me to grapple with the problems of the telephone. Nor should I neglect to include the influence of the important men with whom I was thrown into contact through my father's work. My father was personally acquainted with most of the men who were prominent in these lines of enquiry, and of course I, as I grew up, came to know them, too.

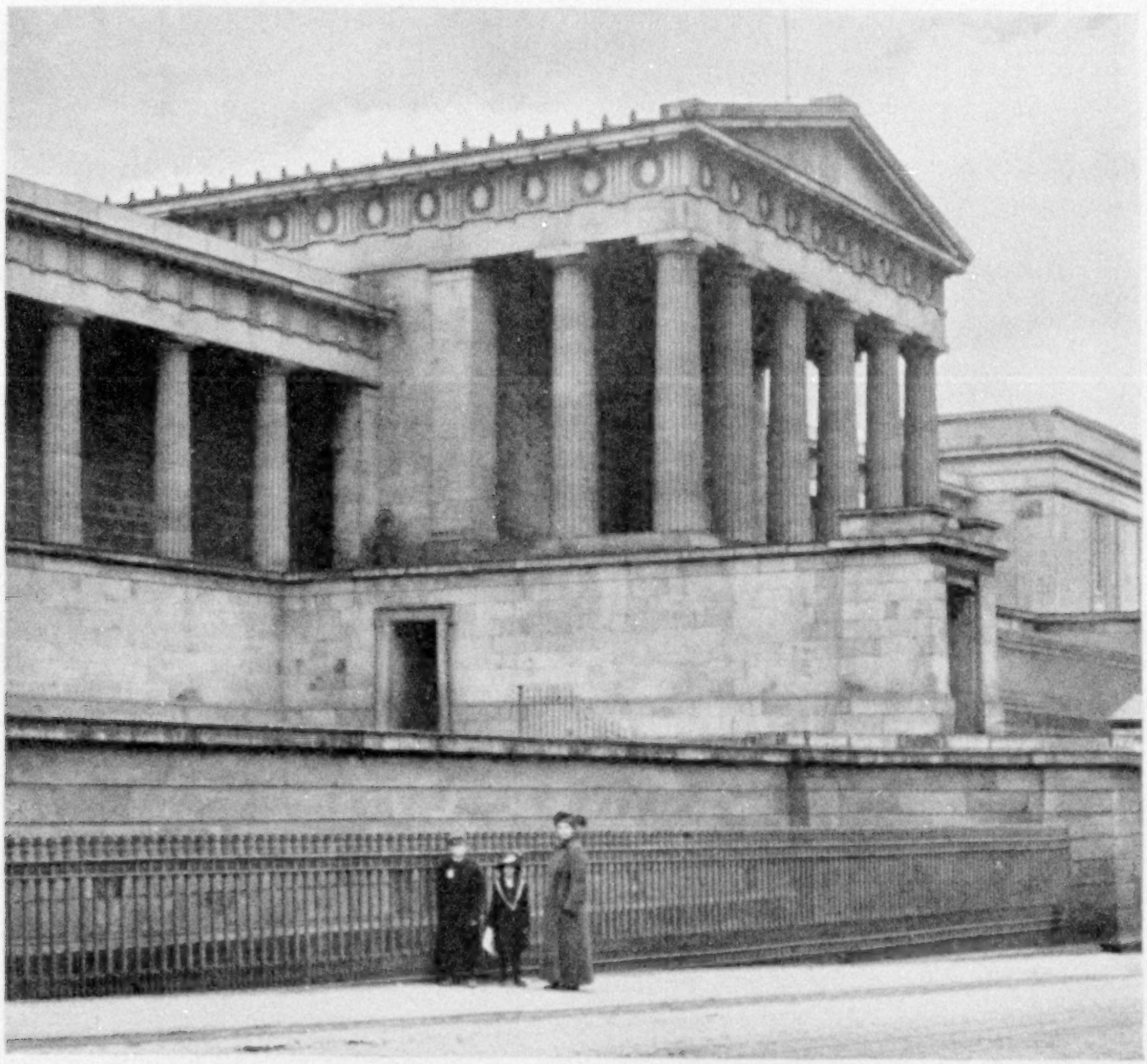
I recall at the present moment Alexander J. Ellis, the translator of Helmholtz; Max Muller, the Sanskrit scholar, professor of modern languages at Oxford University; Henry Sweet, the phonetician; Dr. Furnival, the secretary of the



Photograph by William Reid

EDINBURGH CASTLE FROM PRINCES STREET GARDENS: EDINBURGH, SCOTLAND

It was in the shadow of this historic pile that Alexander Graham Bell spent his boyhood—the period during which he began the experiments which led up to his scientific achievements of later years and which he characterizes as "Prehistoric Telephone Days."



Photograph by Gilbert Grosvenor

THE ROYAL HIGH SCHOOL IN EDINBURGH WHICH ALEXANDER GRAHAM BELL ATTENDED AS A BOY

Philological Society of London; Dr. Murray, afterwards Sir James Murray, the editor of the great Oxford Dictionary; Prince Lucien Bonaparte, student of Scottish dialects; and Sir Charles Wheatstone, who is often credited, in England, with the invention of the electric telegraph.

When quite a lad I came into personal contact with these and many other prominent men. Ellis, Sweet, Furnival, and Murray I came to know very well; but most of the others I merely met casually during the course of interviews with my father.

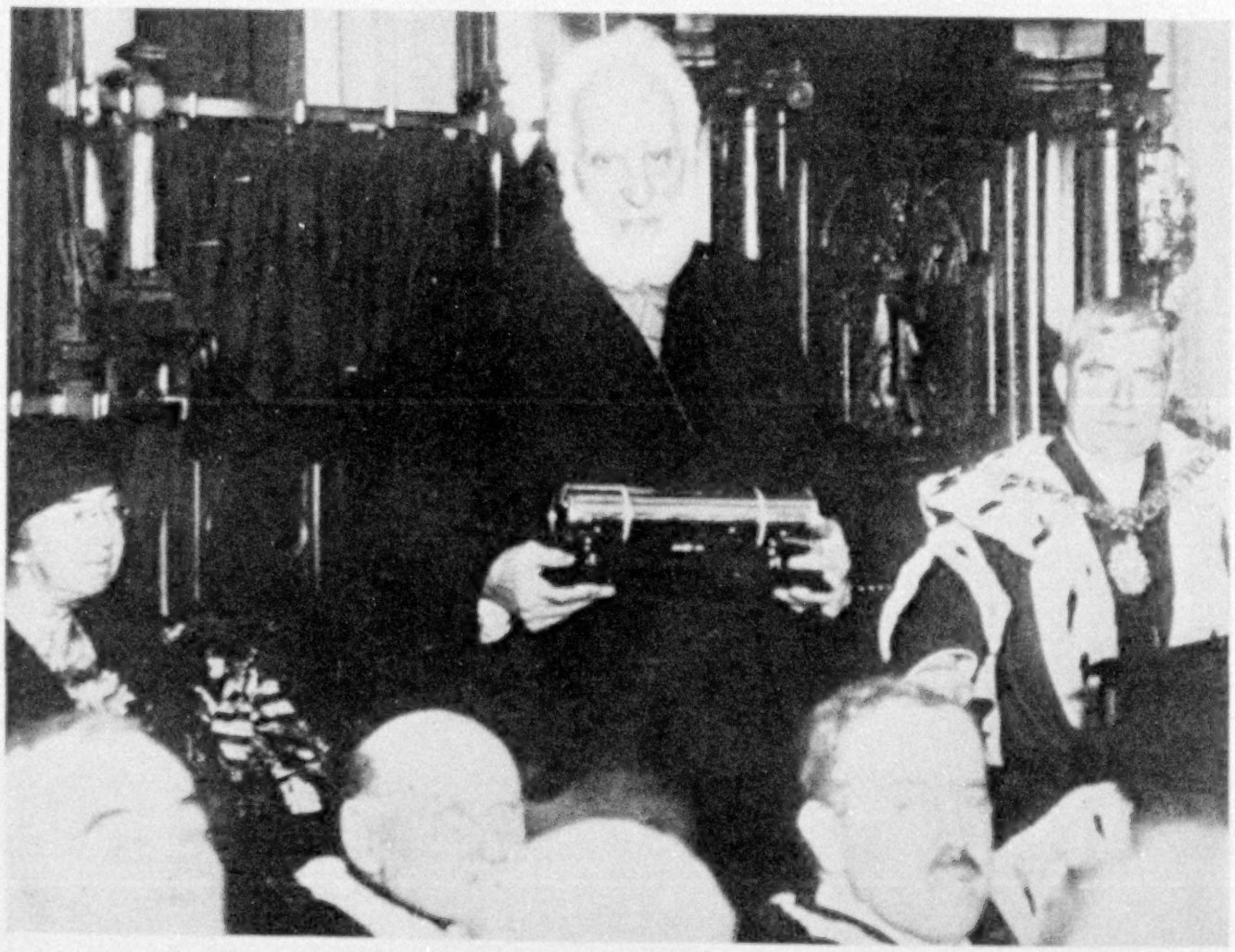
SIR JAMES MURRAY

With Dr. Murray especially I became well acquainted. He was a profound student of phonetics and quite familiar with the Melville Bell Symbols, and he made my father's classification of speech sounds the basis of his method of noting pronunciation in the Oxford Dictionary, the "permanent standard," to which the characters employed in the dictionary should be referred in order to fix their pronunciation.

Dr. Murray was one of the kindest and gentlest men I ever met. He early won my deepest respect and esteem and even affection, and I gratefully acknowledge the kindly influence he exerted over me as a young man. In process of time we became quite intimate, and he did me the honor of selecting me to be best man at his wedding.

ALEXANDER J. ELLIS

To Alexander J. Ellis I owed my first knowledge of the researches of Helmholtz.



Photograph from Underwood & Underwood

DR. BELL RECEIVING THE FREEDOM OF HIS NATIVE CITY UPON THE OCCASION OF HIS RETURN ON A VISIT FIFTY YEARS AFTER MAKING HIS HOME IN AMERICA

The inventor is holding in his hands the silver cylinder containing the certificate presented to him by Lord Provost Chesser (at the right) symbolizing Edinburgh's open door to her distinguished son.

At the age of 18 years I communicated to Mr. Ellis my discovery that in uttering the vowel elements of speech faint musical tones could be heard accompanying the sound of the voice.

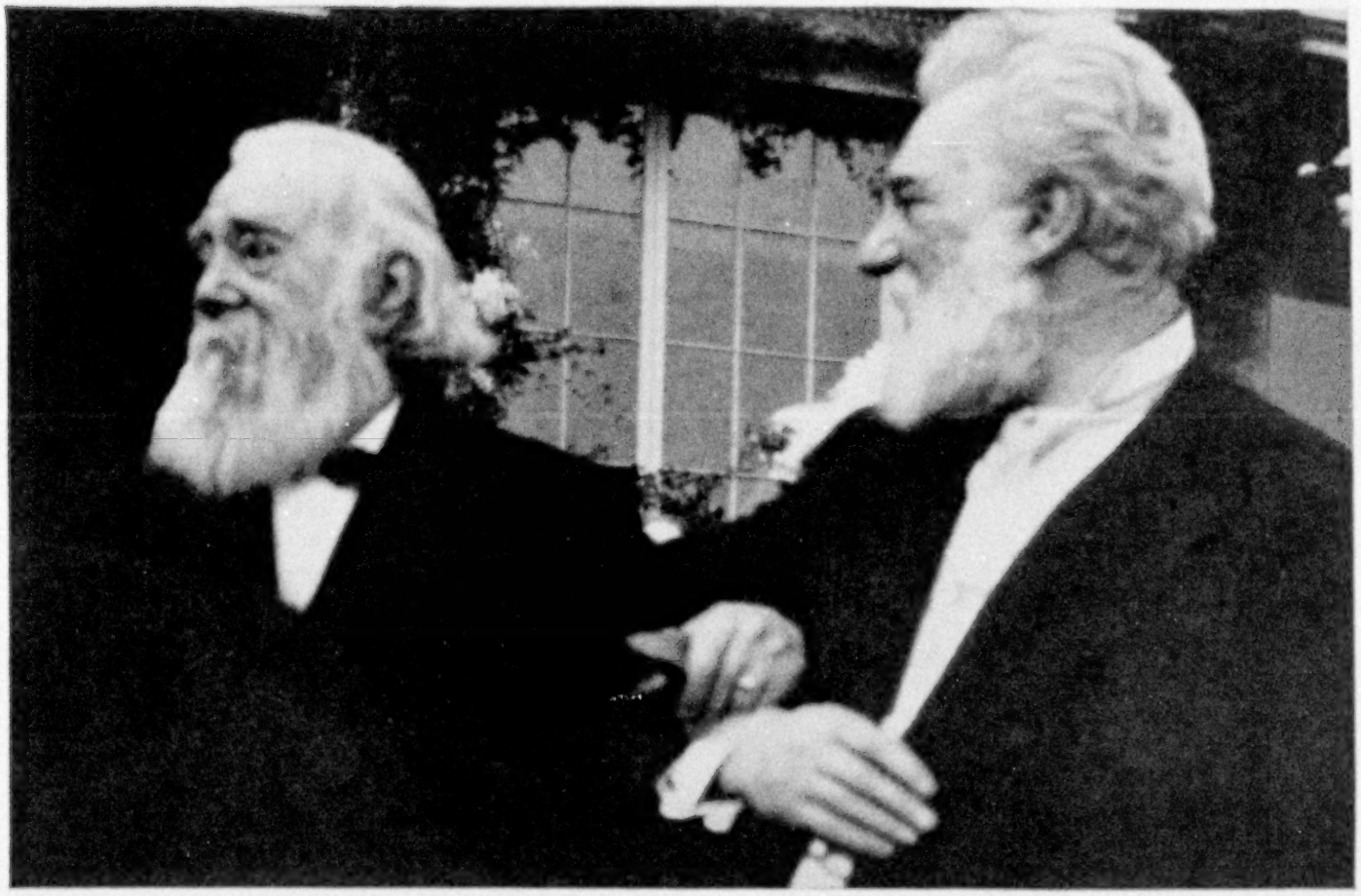
These feeble tones seemed to be characteristic of the different vowels, and had the same pitches as the resonance tones of the various cavities formed in the mouth when the vowel positions were silently assumed and the resonance tones brought out by tapping against a pencil held against the cheek or throat.

Mr. Ellis expressed great interest, but informed me that I had been anticipated by Helmholtz, who had not only analyzed vowel sounds into their constituent musical elements, but had actually produced vowel sounds by a synthetical process, by combining musical tones of the required pitches and relative intensities. He had produced these musical tones by means of tuning-forks which were kept in vibration by an electrical current, and had controlled the relative intensities by resonators applied to the forks.

At this time I knew nothing whatever about electricity, and found myself quite unable to understand, from Mr. Ellis' explanation, how tuning-forks could be made to vibrate by an electrical current.

Helmholtz' work had not then been translated into French or English and I was unable to read it in the original German. I therefore took up the study of electricity, and began to experiment with electrical apparatus in the hope that I might ultimately be able to construct Helmholtz' vowel apparatus and repeat his experiments.

When at last, after my arrival in America, I succeeded in vibrating tuning-forks, and tuned plates and reeds by electrical means, I made a number of electrical inventions based upon the utilization of musical notes as telegraphic signals;



Photograph by Gilbert Grosvenor

FATHER AND SON: ALEXANDER MELVILLE BELL (1819-1905) AND ALEXANDER GRAHAM BELL IN 1905

and these led gradually to the invention of the telephone itself.

But I need not enlarge upon this subject here, as you are already familiar with the development of the telephonic art, and I wish to confine my remarks as much as possible to boyish incidents, with which you may not be familiar.

PRINCE LUCIEN BONAPARTE

Prince Lucien Bonaparte was a distinguished scientific man, residing, I believe, in London, who made personal tours of Scotland, mapping out the geographical boundaries of the various Scottish dialects. As my father was a recognized authority upon dialects, the Prince invited him to dinner to talk over the subject, and I also was included in the invitation. I was only a boy at the time, but old enough to be duly impressed with the distinguished honor of dining with a real live prince.

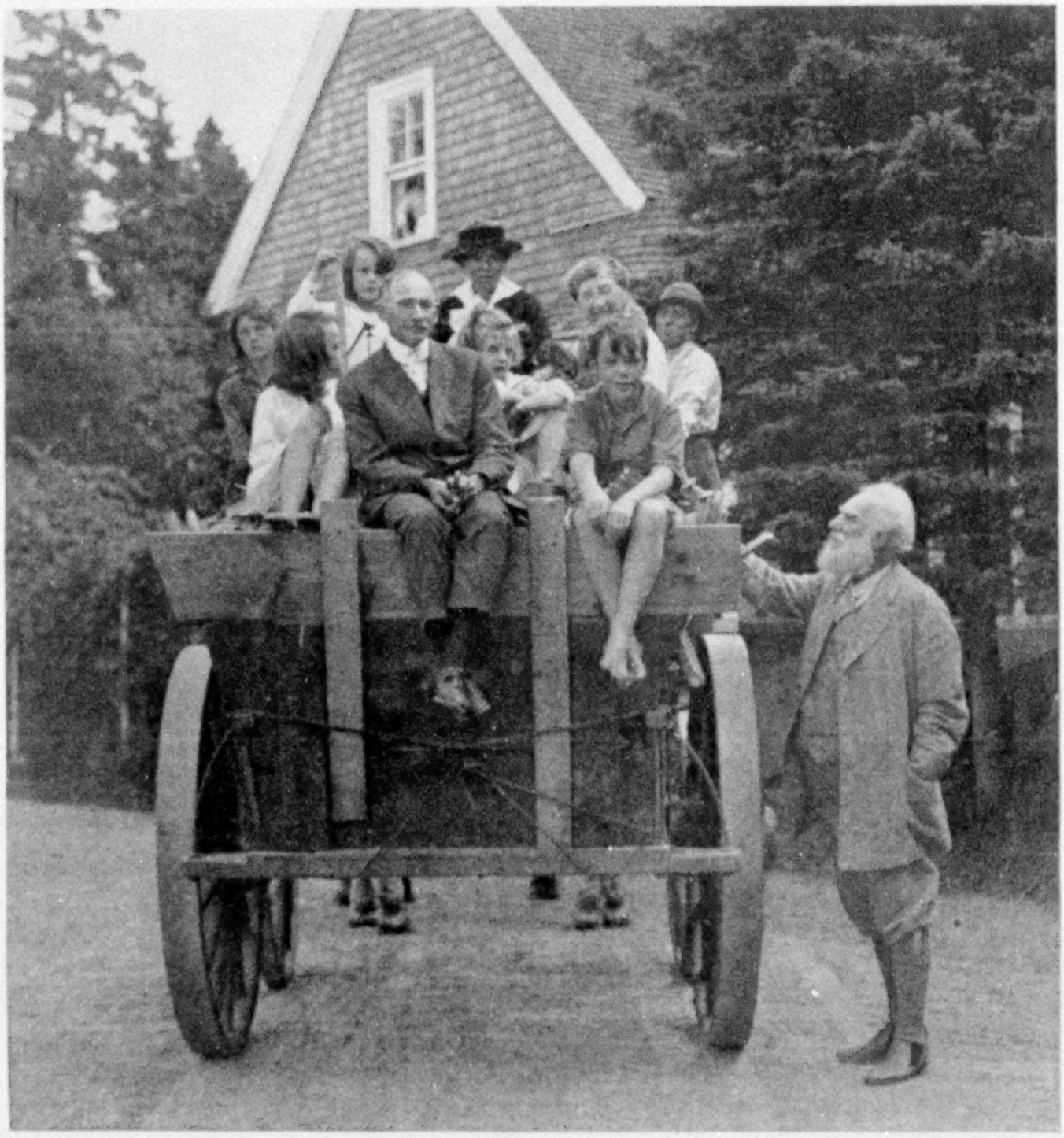
I did not understand very much of the subjects of conversation, and was more impressed, I think, by the dignity and elegance of the three waiters, who stood at attention behind our three chairs. One put a plate with something on it right in front of me, and I was especially interested in the mysterious appearance of a hand the moment I let my knife or fork rest on my plate, followed by the sudden disappearance of the plate and the arrival of another.

I am afraid I was much more interested in this strange phenomenon than in the discussions that were going on between my father and the Prince. I amused myself, however, by counting the number of courses until finally I lost count. My boyhood recollection was that there were over twenty courses, but I am a little more doubtful about that now.

SIR CHARLES WHEATSTONE

I was also quite young when I had the opportunity of meeting Sir Charles Wheatstone. The interview at which I was present had nothing to do with electricity or the electric telegraph, but related to a very different subject altogether.

You have probably all heard of the celebrated automaton chess-player of the Baron von Kempelen, which appeared in



Photograph by Charles Martin

DR. AND MRS. BELL AND SOME OF THEIR GRANDCHILDREN AND FRIENDS: CAPE BRETON ISLAND, NOVA SCOTIA

the eighteenth century and startled all Europe by beating the most celebrated chess-players on the Continent. The story has come down to us that a dwarf was concealed in the apparatus, who guided the machinery and dictated the moves.

Many persons have imagined that the Baron's equally celebrated automaton speaking-machine, which was said to have uttered words and sentences in a childish voice, also constituted an imposition on the public; but, on the other hand, there were some grounds for believing that this might have been a real automaton after all, for the Baron von Kempelen published a book upon "The Mechanism of Human Speech," in which he gave a full description of his speaking-machine, with copious illustrations.

A copy of this book fell into the hands of Sir Charles Wheatstone, and he tested the matter by reconstructing the apparatus from the description and diagrams. My father heard of this and made an appointment with Wheatstone to see the machine and hear it talk; and he took me with him. I was too young to take any part in the conversation that ensued, but

I was a silent and interested observer of all that went on.

I saw Sir Charles manipulate the machine, and heard it speak; and although the articulation was disappointingly crude, it made a great impression upon my mind. Sir Charles very kindly loaned my father the Baron von Kempelen's book, and I devoured it when we reached home. It was in French, but I knew enough of French to be able, with my father's assistance, to read and enjoy the book.

MAKING A TALKING-MACHINE

Stimulated by my father, my brother Melville and I attempted to construct an automaton speaking-machine of our own. We divided up the work between us, his special part consisting of the larynx and vocal chords, to be operated by the wind chest of a parlor organ, while I undertook the mouth and tongue.

My brother and I were very much alike in our tastes and pursuits and even in our personal appearance. We were both fond of making little mechanical devices of various kinds, but we differed in our ability to construct them.

Melville was quite skillful in the use of tools and very neat-handed in everything he did. I, on the other hand, was always clumsy in the use of my hands and inefficient where tools were concerned. I hit upon a plan, however, that obviated the disadvantages of this defect in a great degree: I made my models of *gutta-percha* wherever possible.

This is an admirable substance to bring to a boy's attention. Gutta-percha becomes quite soft in warm water, and if you are careful to keep the hands wet, to avoid sticking, you can mold it into any form desired. Upon cooling, it becomes quite hard and firm. Then, again, you can give it quite a fine finish by smoothing the surface with a hot knife.

A pencil of gutta-percha can be handled like a stick of sealing wax, and can be melted or set on fire over the flame of a candle. The melted drops are quite sticky and adhere to any dry object with the firmness of glue. I used the material in place of glue. For example, in fastening pieces of wood together, I simply rubbed the adjoining surfaces with the melted end of a stick of gutta-percha and pressed them together. At once they adhered with sufficient firmness to avoid the necessity of using tacks, nails, or screws. The joint was quite firm the moment the gutta-percha cooled.

AN ATTEMPT TO COPY NATURE

My father took an extraordinary interest in the proposed talking-machine and encouraged us in every way. I now realize, as I could not then, that he looked upon the machine as a valuable educational toy, which would compel us to become familiar with the operation of the vocal organs, quite independently of any practical results attained. This accounts for the fact that he did not encourage us to follow in the footsteps of Kempelen and Wheatstone, but rather sought to have us copy Nature herself.

In accordance with his advice, we attempted to make an exact copy of the vocal organs, and work the artificial lips, tongue, and soft palate by means of levers controlled by a key-board.

I started out with my part of the work by making a cast from a human skull, and then from this mold produced a replica of the mouth parts of the skull in gutta-percha. This gave us a firm foundation on which to build, consisting of the upper teeth, the upper gum, the hard palate, and the back of the pharynx, with a large hole at the top representing the rear entrance into the nasal cavities.

This hole was covered by a valve, consisting of a piece of wood hinged to the palate and covered with a skin of soft rubber stuffed with cotton batting. The lever to operate it passed through the nasal passages beyond the nose.

The lips were formed of a framework of iron wire covered with rubber stuffed with cotton batting, and rubber cheeks were provided which completely closed in the mouth cavity.

A TONGUE OF WOOD DESIGNED

It was proposed to make the tongue of wooden sections, standing side by side like the dampers of a piano, each section to be pushed up into the mouth by its appropriate lever, the whole tongue to be covered over by a thin skin of rubber stuffed with cotton batting. This part of the apparatus was never actually completed, but sections of the tongue were made and experimented with.

XUM

Photograph by Gilbert Grosvenor

DR. AND MRS. BELL, THEIR TWO DAUGHTERS, AND THEIR GRANDCHILDREN, AT BADDECK, NOVA SCOTIA, IN THE SUMMER OF 1921

While I was working at this apparatus, my brother Melville succeeded in making an artificial larynx, or throat, of tin, with a flexible tube attached as windpipe.

Inside the larynx were two flat sheets of tin sloping upward toward one another, but not touching in the middle. They resembled the roof of a house with the ridge-pole removed.

Stretched tightly upon this structure were two sheets of rubber the edges of which touched one another in the space where the ridge-pole should be.

My brother found, upon blowing through the windpipe, that the rubber vocal chords were thrown into vibration, producing a musical sound. By varying the tension of the rubber strips and by varying the force of the breath, he could make the thing squeak like a Punch and Judy show, or produce a good, sonorous vibration like a reed musical instrument.

THE TALKING HEAD IS ASSEMBLED AND TRIED ON THE NEIGHBORS

When this stage had been reached we were, of course, anxious to put the throat and the mouth together to see what the effect would be. We could not wait for the completion of the tongue; we could not wait for the arrival of the organ bellows. My brother simply fastened his tin larynx to my gutta-percha mouth and blew through the windpipe provided.

At once the character of the sound was changed. It no longer resembled a reed musical instrument, but a human voice. Vowel quality, too, could be detected, and it really seemed as though some one were singing the vowel "ah."

I then closed and opened the rubber lips a number of times in succession, while my brother blew through the windpipe. The machine at once responded by uttering the syllables "ma-ma-ma-ma," etc., quite clearly and distinctly. By using only two syllables and prolonging the second, we obtained a quite startling reproduction of the word "mamma," pronounced in the British fashion, with the accent on the second syllable.

Well, of course, boys will be boys, and we determined to try the effect upon our neighbors.

My father's house in Edinburgh was one of a number of houses and flats that

opened upon a common stair. We took the apparatus out on the common stair and made it *yell!* My brother put the windpipe to his mouth and blew for all he was worth, while I manipulated the lips. Soon the stairway resounded with the most agonizing cries of "Mamma! Mamma! Mamma"! It really sounded like a little child in great distress calling for its mother.

Presently a door opened upstairs and we heard a lady exclaim, "My goodness, what's the matter with that baby"!

That was all that was necessary to complete our happiness. Delighted with our success, we stole quietly back into my father's house and gently shut the door, leaving the poor lady to make a fruitless search for the now silent child.

I do not think that the speaking-machine progressed very far beyond this point; but it had undoubtedly been successful in realizing my father's desire that through its means his boys should become thoroughly familiar with the actual instrument of speech and the functions of the various vocal organs.

In order to show the educational value of the apparatus, allow me to speak of some of the difficulties experienced in making the larynx. It was easy enough for my brother to copy the external appearance of the larynx, but we both found that our ideas concerning the interior arrangements were vague and extremely hazy. We were thus forced to consult books of reference and anatomical drawings, and we also examined a *papier-mâché* model of the human larynx.

KILLING A CAT IN THE INTERESTS OF SCIENCE

Even with these aids we were greatly puzzled by the appearance of the vocal chords. They did not at all resemble "cords" or tightly stretched strings, as we had imagined, and we felt that the only way of completely clarifying our ideas would be to examine the interior of a real larynx. This, however, involved a visit to a dissecting-room and the examination of a dead human body. We were only boys, and shrank with horror from the mere idea of attempting to do this.

We then remembered that we knew of an animal that produced sounds greatly resembling the human voice, especially at night, and wondered whether the throat might not resemble the human larynx we desired to see, so at last we determined to kill a cat in the interests of science. The only trouble was that we were much too tender-hearted to perform the operation ourselves.

We therefore sought the assistance of a friend, a young man who was a medical student and therefore presumably accustomed to deeds of blood. Would he not kill the cat for us, in the most approved and painless fashion and without injuring that precious organ the larynx.

He undertook the job, and so we caught a cat and carried it into my father's greenhouse at Trinity, near Edinburgh. My brother and I held the legs while the medical student forced open the mouth and quickly poured in a liquid warranted to send the cat to sleep. When I tell you that the liquid was nitric acid, you may imagine that that was not the result.

With a single bound the creature was out of our hands and rushing frantically round and round the greenhouse in the greatest agony. I shall never forget the thrill of horror that seized me, as I realized the condition of affairs. It was some time before the poor creature could be caught and put out of its misery; by which time we had completely lost our appetite for dissection. We quietly buried the cat and never even looked at the vocal organs.

It took us quite a long time to recover from the nervous shock of witnessing so terrible a death; but our medical friend—or, rather, fiend—merely laughed. He thought he had played a good joke upon us.

After this we were satisfied to obtain our knowledge of the larynx from a lamb's throat supplied by a butcher.

TEACHING A DOG TO SPEAK

I was always much interested in my father's examinations of the mouths of his elocutionary pupils. They differed in an extraordinary degree in size and shape, and yet all these variations seemed to be quite consistent with perfect speech. I then began to wonder whether there was anything in the mouth of a dog to prevent it from speaking, and commenced to make experiments with an intelligent Skye terrier we possessed.

XUM

Photograph by Gilbert Grosvenor

SUMMER HOME OF DR. ALEXANDER GRAHAM BELL: BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

It is on this estate, overlooking the Bras d'Or Lakes, that Dr. Bell has pursued his eugenic experiments with twin-bearing ewes, and it is here also that he built the HD-4, the flying boat, which attains a speed of 70 miles an hour.

By the application of suitable doses of food material, the dog was soon taught to sit up on his hind legs and growl continuously while I manipulated his month, and stop growling when I took my hands away. I took his muzzle in my hands and opened and closed the jaws a number of times in succession. This resulted in the production of the syllables "ma-ma-ma-ma," etc., as in the case of the talking-machine.

The mouth proved to be too small to enable me to manipulate individual parts of the tongue, but upon pushing upward between the bones of the lower jaw, near the throat, I found it possible to completely close the passageway at the back of the mouth, and a succession of pushes of this character resulted in the syllables "ga-ga-ga-ga," etc.

The simple growl was an approximation of the vowel "ah," and this, followed by a gradual constriction and "rounding" of the labial orifice by the hand, became converted into the diphthong "ow," as in the word "how" (ah-oo), and we soon obtained the final element by itself—an imperfect "oo." The dog's repertoire of sounds finally consisted of the vowels "ah" and "oo," the diphthong "ow," and the syllables "ma" and "ga."

We then proceeded to manufacture words and sentences composed of these elements, and the dog's final linguistic accomplishment consisted in the production of the sentence "Ow-ah-oo-gamama," which, by the exercise of a little imagination, readily passed muster for "How are you, grandmamma" ("Ow-ah-oo-ga-mama")?

THE DOG TRIES IN VAIN TO TALK UNAIDED

The dog soon learned that his business in life was to growl while my hands were upon his mouth, and to stop growling the moment I took them away, and we both of us became quite expert in the production of the famous sentence, "How are you, grandmamma?"

The dog took quite a bread-and-butter interest in the experiments and often used to stand up on his hind legs and try to say this sentence by himself, but without manipulation was never able to do anything more than growl.

The fame of the dog soon spread among my father's friends, and people came from far and near to witness the performance. This is the only foundation for the newspaper stories that I had once succeeded in teaching a dog to speak.

MY FIRST INVENTION

I have often been asked whether I can recall the nature of my first invention and how I came to make it. So far as I can recollect, it came about in this way:

When I was quite a little fellow, it so happened that my father had a pupil of about my own age with whom I used to play. He was the son of a Mr. Herdman, who owned large flour mills near Edinburgh, and, of course, I went over to the mills pretty often to play with him there. We romped about and got into all sorts of mischief, until at last one day Mr. Herdman called us into his office for a very serious talk.

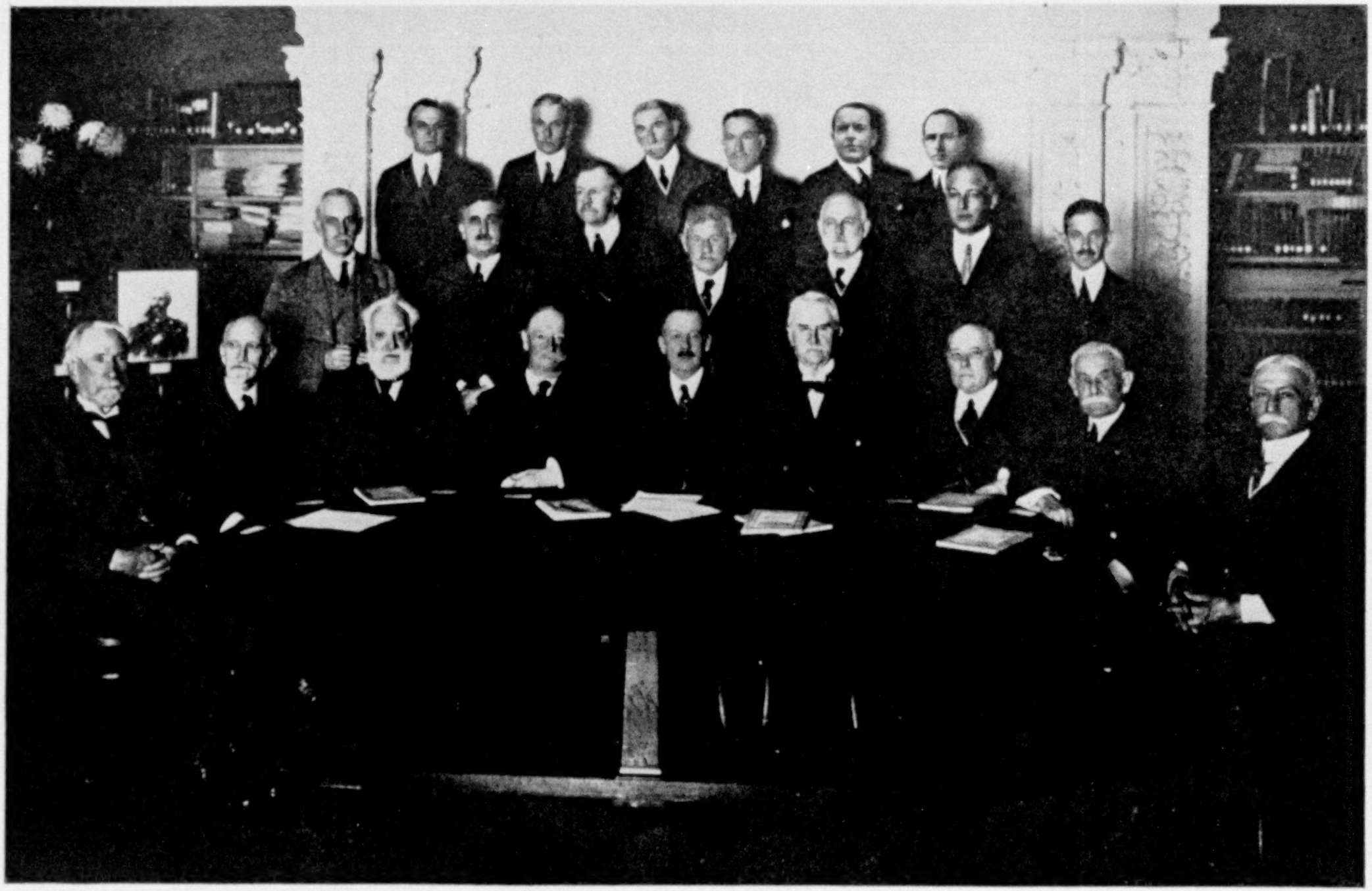
"Why can't you boys do something useful," he said, "instead of always getting into mischief?"

I mildly asked him to tell us some useful thing to do, and he replied by putting his arm into a bag and pulling out a handful of wheat. He showed us that the grains were covered with husks, and said: "If you could only take the husks off that wheat you'd be doing something useful indeed."

That made rather an impression upon my mind, and I began to think, "Why couldn't we take the husks off *by brushing the seeds with a nailbrush!*"

We tried the experiment and found it successful, although it involved a good deal of hard work from the two mischief-makers. We persevered, however, and soon had a nice little sample of cleaned wheat to show to Mr. Herdman. I then remembered that during our explorations at the mills we had come across a large vat or tank with a paddle-wheel arrangement in it that whirled round and round in a casing of quite rough material, brushes or fine wire netting, or something of that sort. If we could only put the wheat into that machine, I thought, the whirling of the paddle should cause the seeds to rub against the rough surface of the casing, and thus brush off the husks.

It was a proud day for us when we boys marched into Mr. Herdman's office, presented him with our sample of cleaned



Photograph by Charles Martin

THE BOARD OF TRUSTEES OF THE NATIONAL GEOGRAPHIC SOCIETY AT ITS MEETING DECEMBER 14, 1921, IN HUBBARD MEMORIAL HALL.

Front row, reading from left to right: James Howard Gore, O. H. Tittmann, Alexander Graham Bell, William Howard Taft, Gilbert Grosvenor, Henry White, John Joy Edson, C. M. Chester, O. P. Austin.

Second row: David Fairchild, George Otis Smith, George Shiras, 3d, Rudolph Kauffmann, Charles J. Bell, Frederick V. Coville, George R. Putnam.

Top row: E. Lester Jones, Stephen T. Mather, T. L. Macdonald, Grant Squires, John Oliver La Gorce, George W. Hutchison.

(Absent because of illness: A. W. Greely, C. Hart Merriam, S. N. D. North.)

wheat, and suggested paddling wheat in the dried-out vat.

"Why," said Mr. Herdman, "that's quite a good idea," and he immediately ordered the experiment to be made. It was successful, and the process, I understand, or a substantially similar one, has been carried on at the mills ever since.

In 1876, about the time when the telephone became known to the world through the Centennial Exhibition, I had in my classes at the Boston University a Japanese student named Issawa. He afterwards became the Japanese Minister of Education in Formosa, and he is still living, I believe, as a member of the House of Peers.*

JAPANESE WAS THE FIRST FOREIGN LANGUAGE SPOKEN BY TELEPHONE

Mr. Issawa was studying with me the pronunciation of English and how the English sounds differed from the Japanese elements of speech. He knew of this curious instrument I had invented, and one day he fairly startled me with a question about it. "Mr. Bell," he said, taking the telephone up in his hand, "will this thing talk Japanese?"

He seemed much surprised when I assured him that it would talk any language, and he immediately proceeded to try it. He spoke into the transmitter while I listened at the receiver. I reported that the telephone was undoubtedly talking Japanese, but unfortunately I could neither speak nor understand the language myself.

He then asked whether he might bring two Japanese friends who were students at Harvard College. They came and soon satisfied themselves that the instrument could be used in Japan.

A great many years afterwards I was in Yokohama when the American residents there were entertaining a new Japanese minister who was about to start for Washington. I attended the banquet and was about to be presented to the minister, when he came forward and said that there was no necessity for introducing him to Mr. Bell, as he knew me years and years ago, when he was a student at Harvard College. He turned out to be one of Mr. Issawa's friends who had been present when Japanese was first used over the telephone.

This was the celebrated Baron Kurino, who was Japan's representative at Washington for some years and afterwards became Premier of Japan and represented his country during the peace negotiations at Portsmouth, New Hampshire, at the conclusion of the Russo-Japanese War.

A few years ago a well-known Japanese gentleman visited the United States in a semi-official capacity to cultivate good relations between America and Japan. He gave a lecture before the National Geographic Society in Washington, and as I happened to be the President of the Society at the time, I entertained the distinguished visitor at dinner. This was Baron Kaneko, who is now, I believe, revisiting America on a similar mission.

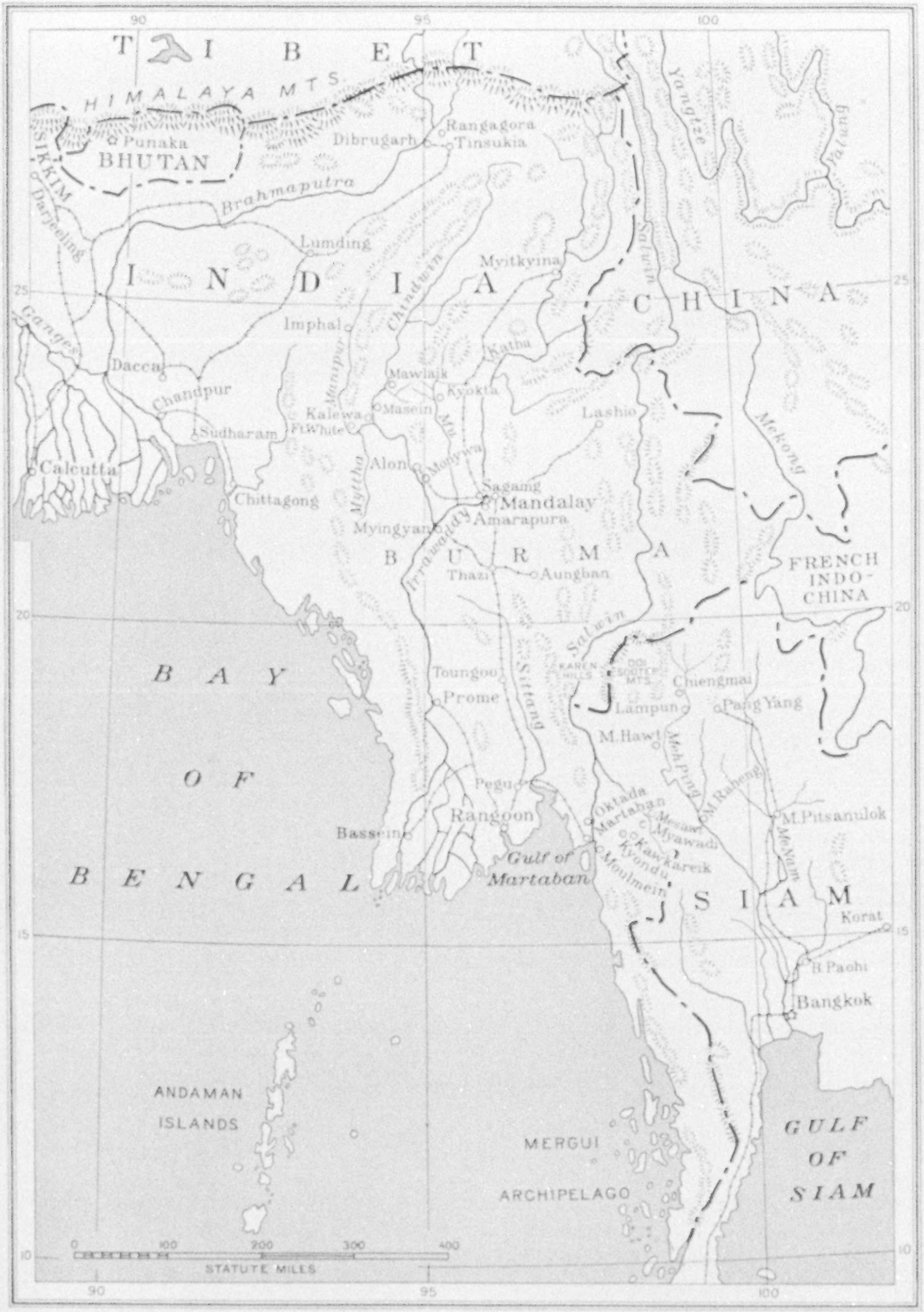
The Baron in his after-dinner speech remarked that this was not the first time he had met Mr. Bell, for he was one of the two students from Harvard College who had spoken through the telephone in 1876.

It is rather interesting to know, not only that Japanese was the first foreign language spoken by telephone, but that the speakers were among the foremost men that Japan has produced.

The telephone has gone all over the world since then. It has grown far beyond my knowledge. The telephone system, as we now know it, is the product of many, many minds, to whom honor should be given for the wonderful and beneficial work it has accomplished. I can only say that I am proud and thankful of the fact that it was my crude telephone of 1874-75 that originated the great industry that we see today, and I hope that you have been interested in hearing something of its prehistoric days.

* A recent note from a cousin of Mr. Issawa informs me that he died a few years ago.—A. G. B.

XUM



Drawn by James M. Darley

A SKETCH MAP OF BURMA, HOME OF THE CHAULMOOGRA-OIL TREE

In his search for the tree whose fruit yields an oil which has proved a panacea for leprosy, Mr. J. F. Rock went first to Siam, entering that country by way of Singapore. He proceeded by rail to Bangkok, thence to Chiengmai and back to Korat, then to Chiengmai again, down the Meh Ping River to Raheng, across country by way of Mesawt, Kawkareik, and Kyondu to Moulmein, to Amarapura, Sagaing, and Monywa by rail, up the Chindwin River to Mawlaik, then eastward through forest and over mountain to Kyokta, where the seed were finally obtained. The Karen Hills, west of Chiengmai, are the home of the tribes described by Sir George Scott, pages 293 to 321 in this number of THE GEOGRAPHIC.

HUNTING THE CHAULMOOGRA TREE

By J. F. Rock

Agricultural Explorer of the Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, U. S. Department of Agriculture

With Illustrations from Photographs by the Author

"CHAULMOOGRA" is no longer a strange-sounding name, for of late it has appeared frequently in newspaper dispatches as a possible cure for leprosy, and in fact two constituents of Chaulmoogra oil, chaulmoogric and hydnocarpic acids, but especially their ethyl esters, have proved efficacious in the treatment of that dreadful disease. These acids were first isolated and described and their esters prepared nearly twenty years ago by Dr. Frederick B. Power and his assistants.

From Hawaii came the message only two years ago that by means of intramuscular injections of the above-mentioned acids extraordinary results had been achieved. Since that time nearly two hundred lepers have been discharged from both the Kalihi Receiving Station in Honolulu and the main settlement at Kalaupapa, on the island of Molokai.

To be sure, the discharged patients are required to report frequently for reëxamination, but so far not one has had to be readmitted to the leper hospitals. Dr. A. L. Dean, of the University of Hawaii, prepared the two acids and their esters in large quantities for clinical use.

Chaulmoogra oil is obtained from the seeds of a tree known as *Taraktogenos Kurzii* King, named by Sir George King in honor of its discoverer, Kurz.

ASIANS HAVE USED THE OIL FOR CENTURIES

The natives of southeastern Asia have long known of the curative properties of Chaulmoogra seeds in skin diseases and especially in leprosy. In fact, they relate in their pre-Buddhistic legendary history that one of the Burmese kings exiled himself voluntarily and retired into the jungles, making a hollow tree his abode. Here he partook of the fruits and leaves of the Kalaw tree (*Taraktogenos Kurzii*), and in time his health was restored.

The oil of the Chaulmoogra seed has been employed by Asians for hundreds of years in a very primitive way, using it both externally and internally; but the latter method is exceedingly disagreeable, as the oil produces nausea and disturbs digestion.

Owing to the high price of the oil in the United States and the probable scarcity of it in the near future, due to its successful application in the treatment of leprosy in Hawaii, I was authorized by the U. S. Department of Agriculture to obtain seeds of this species, to be introduced into Hawaii and our tropical possessions, with a view to establishing Chaulmoogra plantations.

BANGKOK'S CHARM IS DUE TO ITS TEMPLES

The railway between Singapore, my port of debarkation in Asia, and Bangkok has been in operation for several years, and while the distance is only 1,018 miles, the journey takes five days. This is due to the fact that for much of the journey the trains run only during the day; the night must be spent in indifferent rest-houses.

The charm of Bangkok lies in its wonderful temples, of which the Royal Wats are the most gorgeous. The most interesting and historic of these wats is the king's own place of worship, Wat Phra Keo. A wall with battlements and ancient gates of queer design surround this and a number of other wats, including the old Royal Palace. Only the roofs of the temples and the graceful golden prachedis (votive spires) are visible from without, but their gorgeous colors permit the imagination to conjure a picture of even more gorgeous interiors (see pp. 246-250).

Through the courtesy of our American Minister, my host while in Bangkok, I was permitted by the Royal Siamese household to photograph the interiors of the various wats, even the most sacred Wat Phra Keo, with its Emerald Buddha.

The full name of Wat Phra Keo is Phra Sri Ratana Satsadaram. It was be-

A RESTING-PLACE UNDER A MIGHTY TREE IN THE FORESTS OF WESTERN SIAM

Note the gigantic vine which entwines the trunk

gun by Phra Puttha Yot Fa Chulalok "as a temple for the Emerald Buddha, the Palladium of the capital, for the glory of the king and as an especial work of royal piety," in the year 1785. It remained in an unfinished condition until the time of King Chulalongkorn, who made a vow on December 23, 1879, to complete the wat. It was during the celebration of the Siamese Centenary that the wat was dedicated, on April 21, 1882. All expenses connected with the completion of the wat were borne by the privy purse of the king and funds left by King Phra Nang Klao for that purpose.

To go into detail describing the glories of this wat would take many pages; suffice it to say that its tile roof is of Chinese yellow bordered with indigo blue; that the columns are mosaic and its heavy doors of carved wood. The center of interest is its sacred image, the "Emerald Buddha," a green jade figure which sits enthroned under many golden umbrellas, surrounded by praying devas (see page 247). The image was unearthed in 1436, at Kiang Hai, and brought to Bangkok, whence it was once stolen by invading Cambodians, but was recovered by a victorious Siamese army.

The mural decorations of the temple are exquisite. The floor is of tessellated brass, and the walls are covered with frescoes. Surrounding the gilded and carved altar are innumerable offerings which remind one very much of those found in old Christian churches renowned for miraculous healings.

Various buildings are included under the name Wat Phra Keo, such as the heavily gilded prachedi, the Sri Ratana, whose golden tiles were manufactured in Germany at the order of H. R. H. Krom Mun Aditson Udom Det. Weird guards watch before temple gates (see page 246); beautiful trees are artistically placed in Chinese pots, and Confucius and Laotse have places of honor.

KORAT, THE HOME OF THE MAIKRABAO TREE

One of the newest Bangkok temples is found not far from the royal audience hall and is known as Wat Benchama Bopit (see page 250). It is beautifully laid out and the grounds are planted with

AN AGRICULTURAL FAMILY OF LOWER SIAM

Note the prachedi-shaped bonnets worn by the children (see also illustration on page 263).

the Maikrabao, the Siamese tree, *Hydnocarpus anthelmintica*, which yields an oil similar to Chaulmoogra.

No one in Bangkok seemed to know where the Maikrabao was found in a wild state in Siam. It was left for the wife of the Viceroy of Chiengmai, in northern Siam, to inform me that it occurred plentifully in her native home, near Korat, in eastern Siam.

Wat Luang is the chief glory of Lampun (see page 251). Its votive spire has an outer casing of brass and is about 80 feet in height. The structure is surrounded by a brass railing and at the corners are small temples with stone figures. Before each of these guardian angels there stands a huge gilt umbrella.

The road from Lampun to Chiengmai leads through small villages and beautiful groves of Mai Yang trees (see page 259), which later give place to planted Rain or Monkeypod trees, as they are known in Hawaii.

A ROYAL GARDEN PARTY IN SIAM

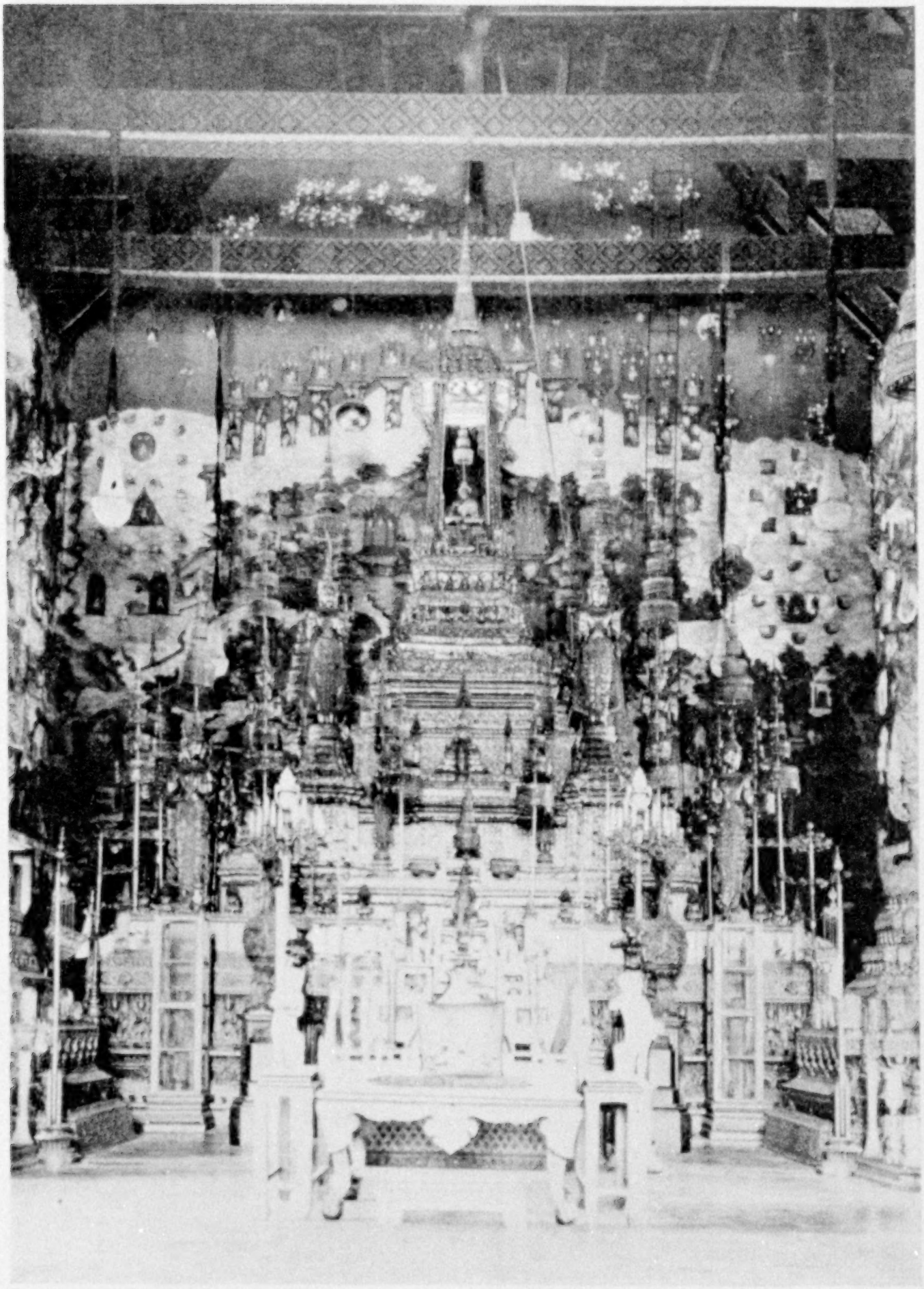
In Chiengmai, situated on the banks of the Meh Ping, "Giver of all Prosperity," we were cordially received by H. S. H. Bovaradej and his wife, the first lady of the Lao States.

Entertainment followed entertainment, the series culminating in a garden party on the lawn of the Viceroy's residence facing the Meh Ping, which then reached almost to the level of the road. It was a moonlight night, flags and lampions decorated the trees, and to the soft murmur of the peaceful waters of the river, on whose placid surface the moon was reflected, old Lao orchestras played weird chords which harmonized with the fantastic movements of strangely costumed Lao spear and sword dancers. These agile and graceful Lao ladies wielded long spears with great dexterity. A Siamese military band played strange and yet familiar airs at intervals, and it was long after midnight before this really royal entertainment came to a close.

Chiengmai boasts of some fourscore temples, of which the most important is Wat Luang (see page 256), which was built in 1881, on the same compound with the ruins of an earlier temple. In this city, as probably elsewhere in Siam, there is no "merit" in repairing a prachedi or wat; hence the numerous ruins and the

STRANGE GUARDS WATCH BEFORE THE SHRINES IN THE WAT PHRA KEO TEMPLE GROUNDS AT BANGKOK (SEE TEXT, PAGES 243-244)

Many buildings are included under the name of this temple. Among these is the heavily gilded prachedi (shrine), the Sri Ratana, whose golden tiles were manufactured in Germany by royal commission.



THE EMERALD BUDDHA, A BEAUTIFUL GREEN JADE FIGURE ENTHRONED UNDER GOLDEN UMBRELLAS AND SURROUNDED BY PRAYING DEVAS

This image in the Wat Phra Keo was unearthed at Kiang Hai nearly five centuries ago, and was borne to Bangkok, where it was once stolen by invading Cambodians, but was recovered by a victorious Siamese army (see text, page 244).

BANGKOK'S WAT PO, SHOWING THE HUGE PRACHEDIS COVERED WITH VARICOLORED PORCELAIN (SEE TEXT, PAGE 243)

The beautiful Buddhist temples give Bangkok a notable appearance. It is a modern city of half a million inhabitants. Until 1769 it was merely an agricultural village, but in that year it became the headquarters of Paya Tak, who drove out the Burmese and became King of Siam.

activity displayed in the erection of new temples.

Wat Phra Sing, second in importance, was built about a hundred years ago. The main building is now in such a dilapidated state that entrance to it is prohibited. Two leogryphs of brick and mortar guard the entrance to the grounds (see page 258), in which are several buildings besides the main wat. In the rear is a small wat in much better repair than the main building. The interior is decorated with frescoes, and the altar, on which three Buddhas are seated, is heavily gilded.

TEMPLE ROOF TILES REMOVED TO GET A PHOTOGRAPH

I took photographs of the mural frescoes, but, as the light was rather dull, the head priest of the temple, whom I photographed at the entrance near the white dragon (see page 253), suggested that a number of tiles should be removed from the roof to make the lighting effect more even. Whereupon a young priest climbed to the roof and removed a dozen tiles and I was enabled to photograph all the various panels, one representing the story of the God of the Magic Flute.

To the right of this building there is a less pretentious structure, where the priests take their vows (see page 258). We spied a long, narrow box in which was a roll about twenty-five feet long and fifteen feet wide, on which was painted the figure of a huge Buddha on a lotus flower. We were informed by our friendly priest that in times of severe drought this picture is taken to the top of Doi Sootep, a sacred mountain, where a magnificent wat was erected many years ago, and there, to the accompaniment of incantations, it is held on high by priests, and invariably rain descends to refresh man and beast and save the rice crops.

Very interesting are the libraries in every temple compound. They are the repository of Buddhist scriptures written by some devout hand with brass or iron stiles on the leaf segments of the Talipot palm. These palm-leaf scriptures are carefully wrapped, usually in yellow cotton cloth or silk, and placed in these libraries as a meritorious act. They are read only rarely and on special occasions. Like the temples, the libraries are rarely repaired (see page 256).

Chiengmai was founded more than 600 years ago. It soon gained in importance and attracted the attention of the Burmese and the Shans, who alternately conquered and sacked it.

THE RAILROAD IS REVIVING CHIENGMAI

A hundred years ago several princes, all brothers, came from Lakon, founded the last Lao dynasty, and raised Chiengmai to its former importance, which has greatly advanced under the wise rule and guidance of the Siamese Government.

The railway is soon to connect Chiengmai with Bangkok, and construction trains have already reached this north Siam outpost. When a regular service is established, within the next two or three years, the rich Meh Ping Valley will be opened for development. The forests of this region abound in teak, the logs of which are now floated down the Meh Ping River through gorges and over rapids which necessitate the employment of elephants to dislodge them from the rocks and banks of the river.

The north is rich and life is easy. Many claim that the railway, while a great blessing, will destroy the quaintness and charm of the city. It is as yet untrodden by tourists, for there are neither hotels nor boarding-houses, and the visitor is obliged to accept the generous hospitality of the American Mission.

DOI SOOTEP, CHIENGMAI'S SACRED MOUNTAIN

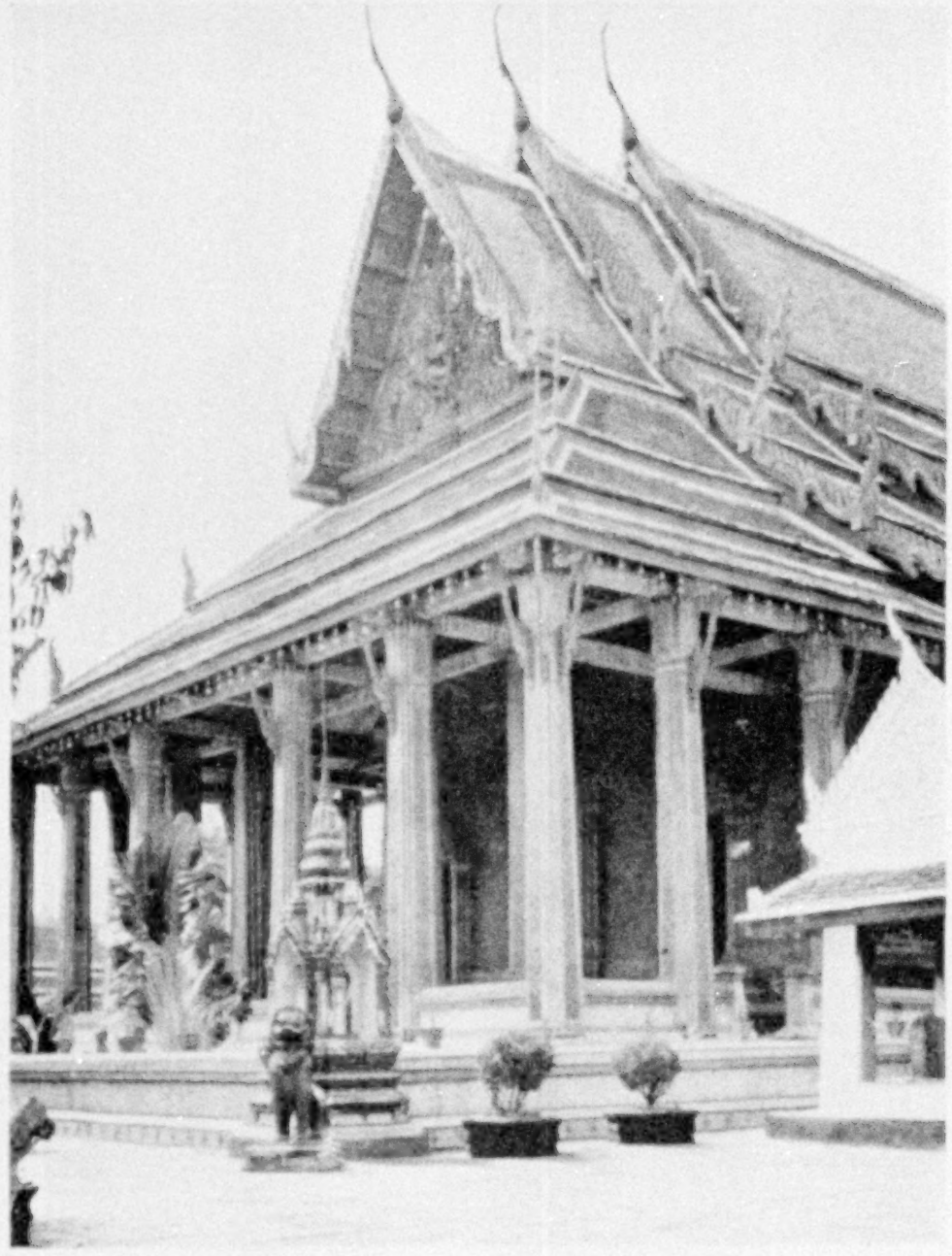
The chief point of interest in the vicinity of Chiengmai is Doi Sootep. It is reached by a splendid road, which leads through old gates to the ruined wall of the ancient city, with its moat filled with lotus flowers, and across rice fields covered with temple ruins, now the habitat of snakes and lizards and overgrown with trees and vines. We pass the only remaining glory of an ancient dynasty, numerous tombs of former Lao princes. Their ashes are buried under splendid monuments, of which the central and largest marks the spot where sleeps cruel Kowilarat, the last Lao king.

Next to Wat Suan Dork (literally, flower garden), as the mausoleum ground is called, is a temple sufficiently spared by the elements and time to bear witness to its former glory. Its gates of stone re-

XUM

BUDDHAS IN THE WAT BENCHAMA BOPIT: BANGKOK

These images, showing the Teacher of the Law and Middle Way in various attitudes, are the gifts of princes. The first image represents Gautama before he reached Buddha-hood, after his forty days of fasting (see text, page 244).

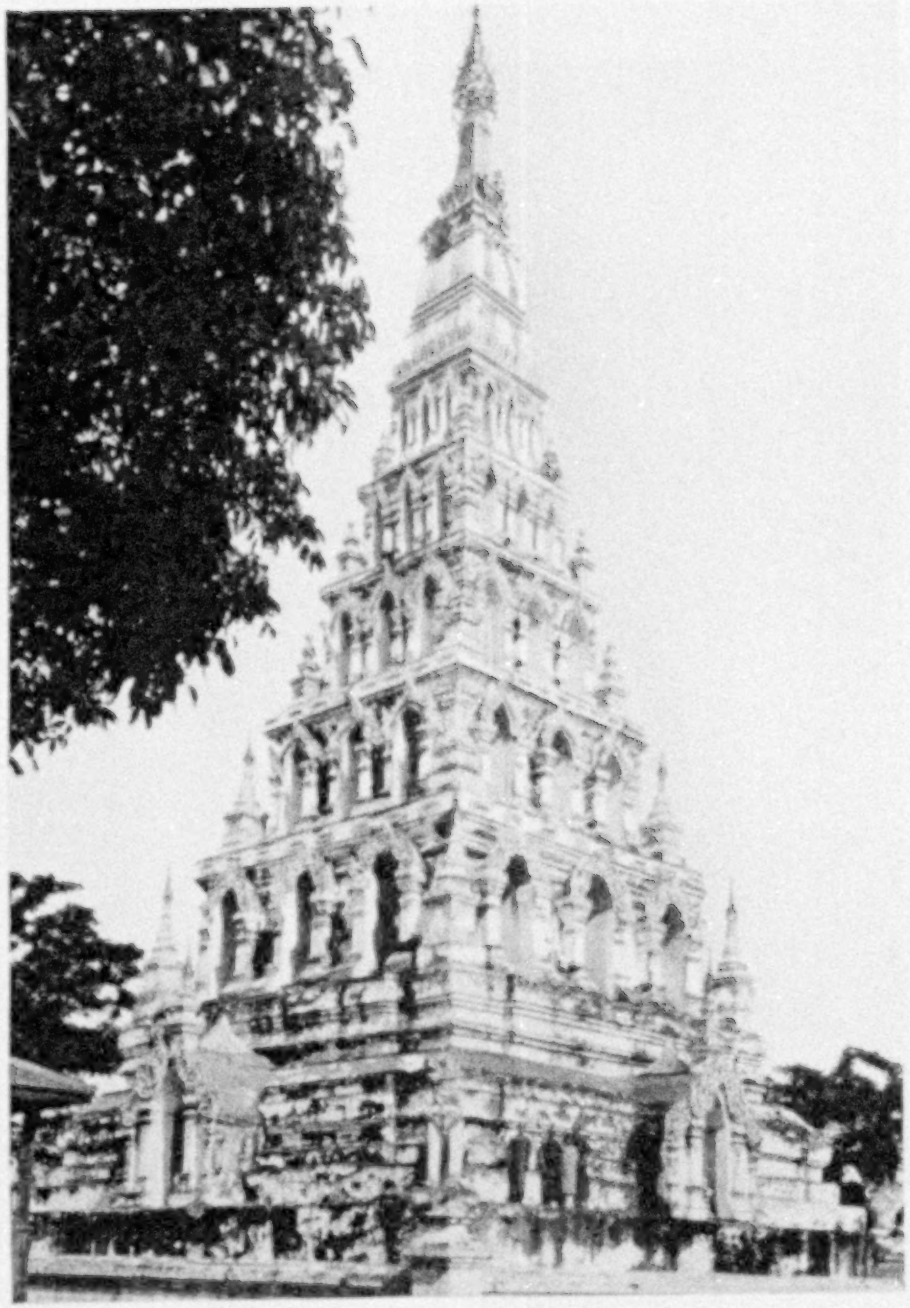


THE EMERALD BUDDHA TEMPLE, THE GLORY OF BANGKOK

This is the place of worship of Siam's king. The roofs are of Chinese imperial yellow tile bordered with indigo blue, while the pillars are of exquisite mosaic. The center of interest in this temple is the Emerald Buddha (see page 247).

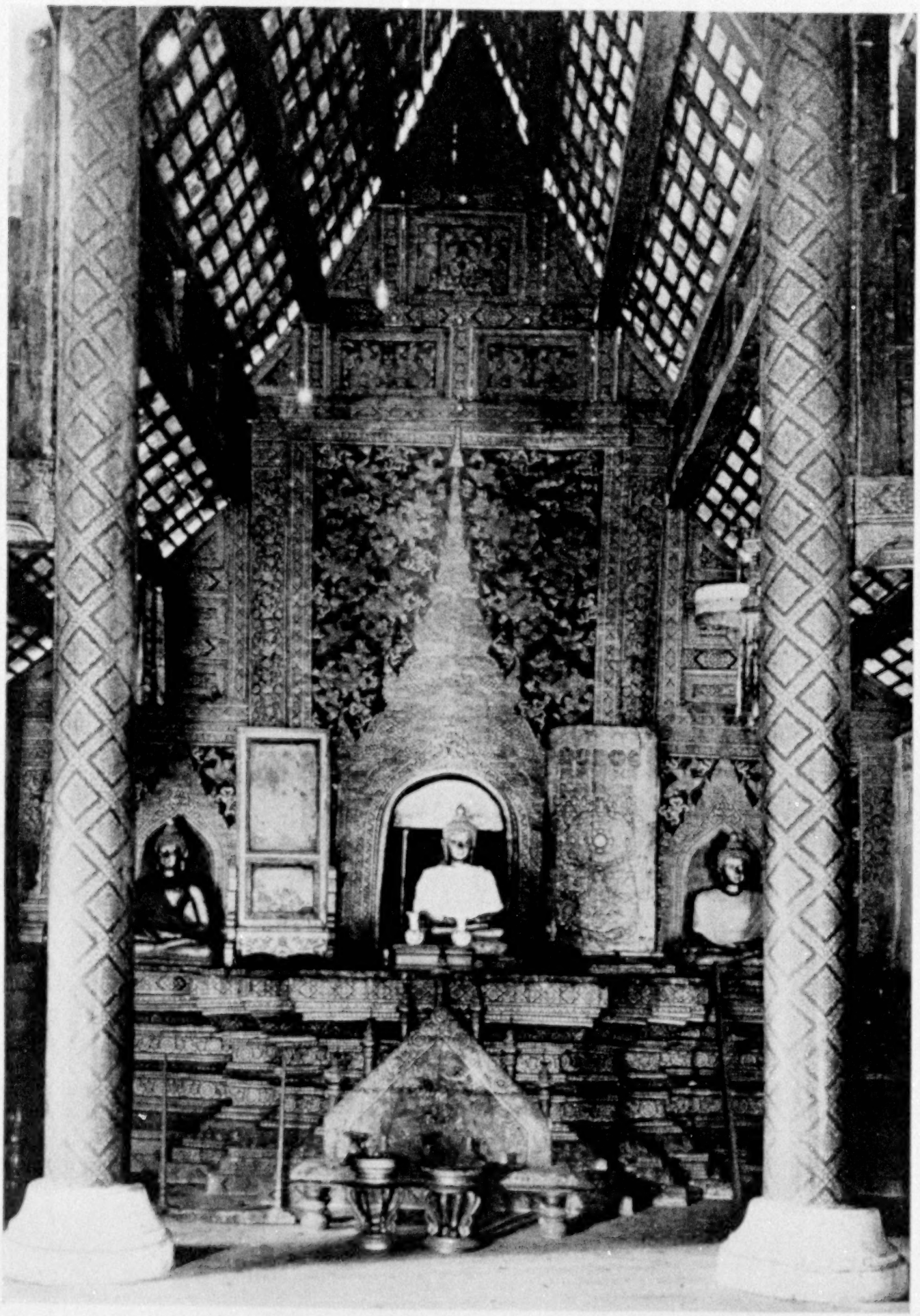
THE PRIESTS OF LAMPUN AT THE BASE OF THEIR CITY'S CHIEF VOTIVE SPIRE (SEE TEXT, PAGE 245)

Wat Luang, which rises to a height of 80 feet, has an outer casing of brass. It is surrounded by a brass railing, at the corners of which are small temples with stone figures, before each of which stands a huge gilt umbrella.



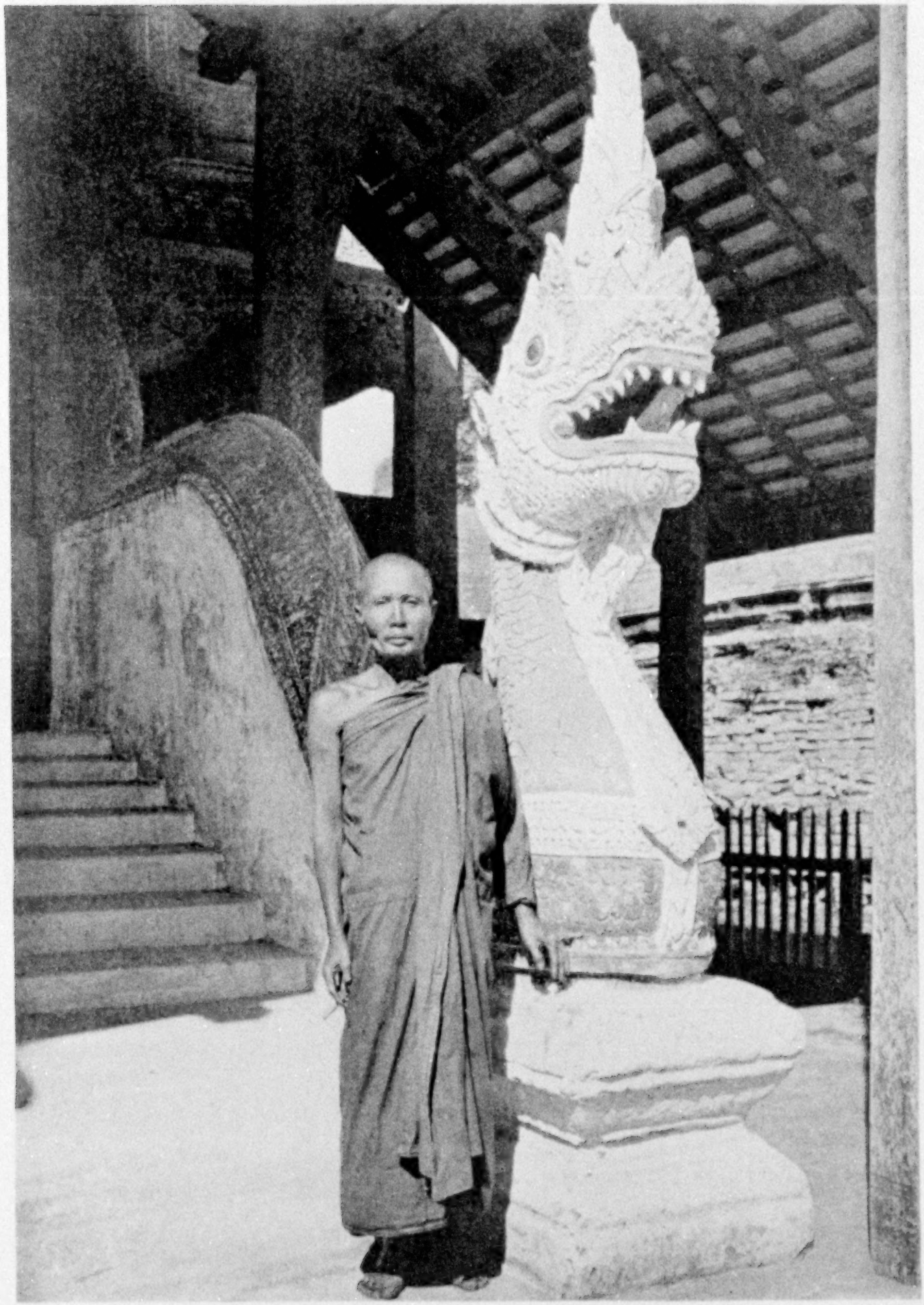
SI LEAM, THE ORNATE FOUR-CORNERED PAGODA, ONE OF CHIENGMAI'S FOUR-SCORE TEMPLES

When the remaining 42 miles of the Bangkok-Chiengmai Railway are completed and a regular service is established, Chiengmai will be the center of the development of the rich Meh Ping Valley, whose forests abound in teak (see text, page 249).



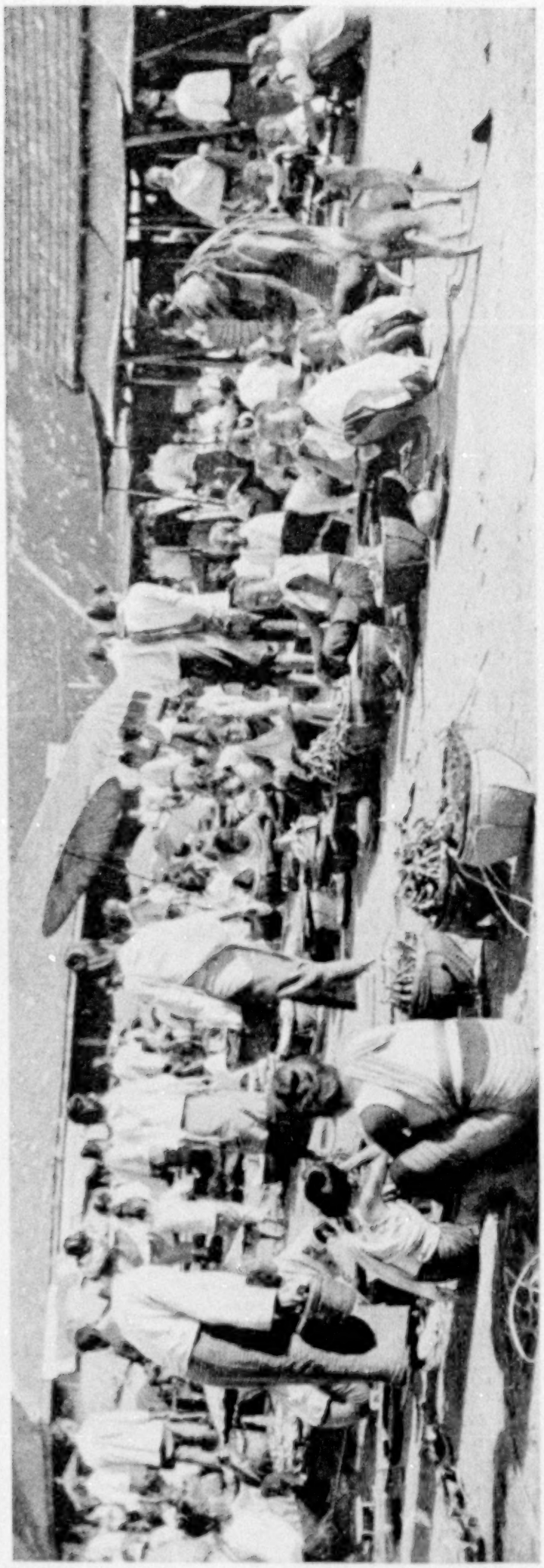
THE INTERIOR OF WAT PHRA SING, THE SECOND TEMPLE OF IMPORTANCE IN CHIENGMAI (SEE TEXT, PAGE 249)

Unlike the famous cathedrals of the Western World whose beauty is only mellowed by the centuries, the temples of Siam soon fall into decay. This structure was built only a hundred years ago, but its entrance is so dilapidated that entrance to it is prohibited.



THE CHIEF PRIEST OF WAT PHRA SING STANDING BESIDE THE WHITE DRAGON OF HIS TEMPLE (SEE TEXT, PAGE 249)

A worshiper is often seen with a cigarette in his hand while he makes his supplication to Buddha, for the Siamese are inveterate smokers. The dilapidated temple buildings of Chiengmai in many cases are dens for snakes and lizards.



THE MARKET AT CHIENGMAI IN THE EARLY MORNING HOURS

Here, women are the only venders of the vegetables, curries, and fish which are the principal articles for sale. Chiengmai is the capital of the Lao States (see text, page 249).

mind one much of the famous Boro-Budur of Java.

The sun's rays descend mercilessly from an azure sky, and so we hurry on to Doi Sootep, where we are soon embraced by the cool shade of its majestic forests.

The ascent is at first steep and rocky. Gorgeous flowering crape myrtle trees border the trail, while higher up Dipterocarpaceæ, with mighty trunks and spreading crowns, give the landscape a bold aspect. Nature writes its story with a mighty hand, and orchids and graceful vines on the wayside are the commas and exclamation points of a harmonious composition. It would require a book of many pages to tell the story of the flora of this wonderful mountain.

Doi Sootep is really the name of a small mountain top crowned by a magnificent wat, which is visible from any place in the Meh Ping Valley. Lao Buddhists have always been great lovers of nature, and, like the great Kobo Daishi of Japan, who built his retreat and place of worship among the sacred pines, and Koya-makis of Koya San, they have retired to the sacred forests and hills to worship the teacher of the law and of the middle way.

LIVING COLUMNS OF PINE FORM THE TEMPLE'S APPROACH

What a glorious approach to this wat! No stone stairway lined by marble pillars or wayside shrines, but living columns of pines festooned and garlanded with sweet-scented orchids and vines, the steps covered with a living carpet of velvet moss; no organ played by human hands, but gentle breezes whispering in the trees and a chorus provided by feathered songsters whose

abode is in the mighty fronded canopy surrounding this hallowed spot.

Doi Chom Cheng is the summit of this mountain range where I camped under pines, oaks, and chestnuts. The chestnuts reach a height of seventy feet and their fruit is excellent. So far as I could determine, the trees have not been attacked by the chestnut blight, which has wrought so much havoc in the forests of our Eastern States. I had all the oaks collected, especially those of economic importance, and of course, all the chestnuts which I could possibly gather, for introduction into the United States.

I explored this mountain region as thoroughly as time permitted, but was handicapped by rain, which brought the leeches out and made walking through the forest very disagreeable.

As a result of my stay in Chiengmai and Doi Sootep, we have now growing in America several species of edible oaks and thousands of chestnut trees which will undoubtedly prove hardy in Florida and perhaps as far north as South Carolina.

THE SEARCH FOR THE CHAULMOOGRA TREE BEGINS

After a quick trip to Korat, where the Siamese Maikrabao tree (*Hydnocarpus anthelmintica*) was obtained, I returned to Chiengmai and chartered a house-boat for a journey down the tortuous Meh Ping River to Raheng, and thence overland to Moulmein, Burma (see map, page 242).

I left Chiengmai December 2, on a commodious house-boat manned by a Lao crew, an interpreter, a would-be cook and boy. Dr. McKean, superintendent of the leper settlement, who is doing a noble work, waved a last good-bye, and slowly we glided down placid waters, avoiding many river-boats anchored midstream near sand banks.

We spent the first of ten nights on this glorious river at Ta Sala.

The night was cold and the dew heavy, but the sky was starlit, although in the morning a heavy fog settled over the river, delaying our departure. At this point the river is wide and the flat banks are fringed with mighty bamboos and silk-cotton trees.

After several days' journey the scenery changed, and we entered mighty gorges, defiles, and forested mountains, which were here and there crowned by a wat or small Buddhist shrine glistening in the sunlight.

Many times during the day I would stop the boat (see page 266) and climb the mountains to explore the forests and collect plants. Legends are connected with many places along this river and one spot on a semi-barren mountain slope is pointed out to the traveler as the place where Buddha crossed this hill with a fighting cock, which scratched the surface of the ground to such an extent as to leave these places bare today.

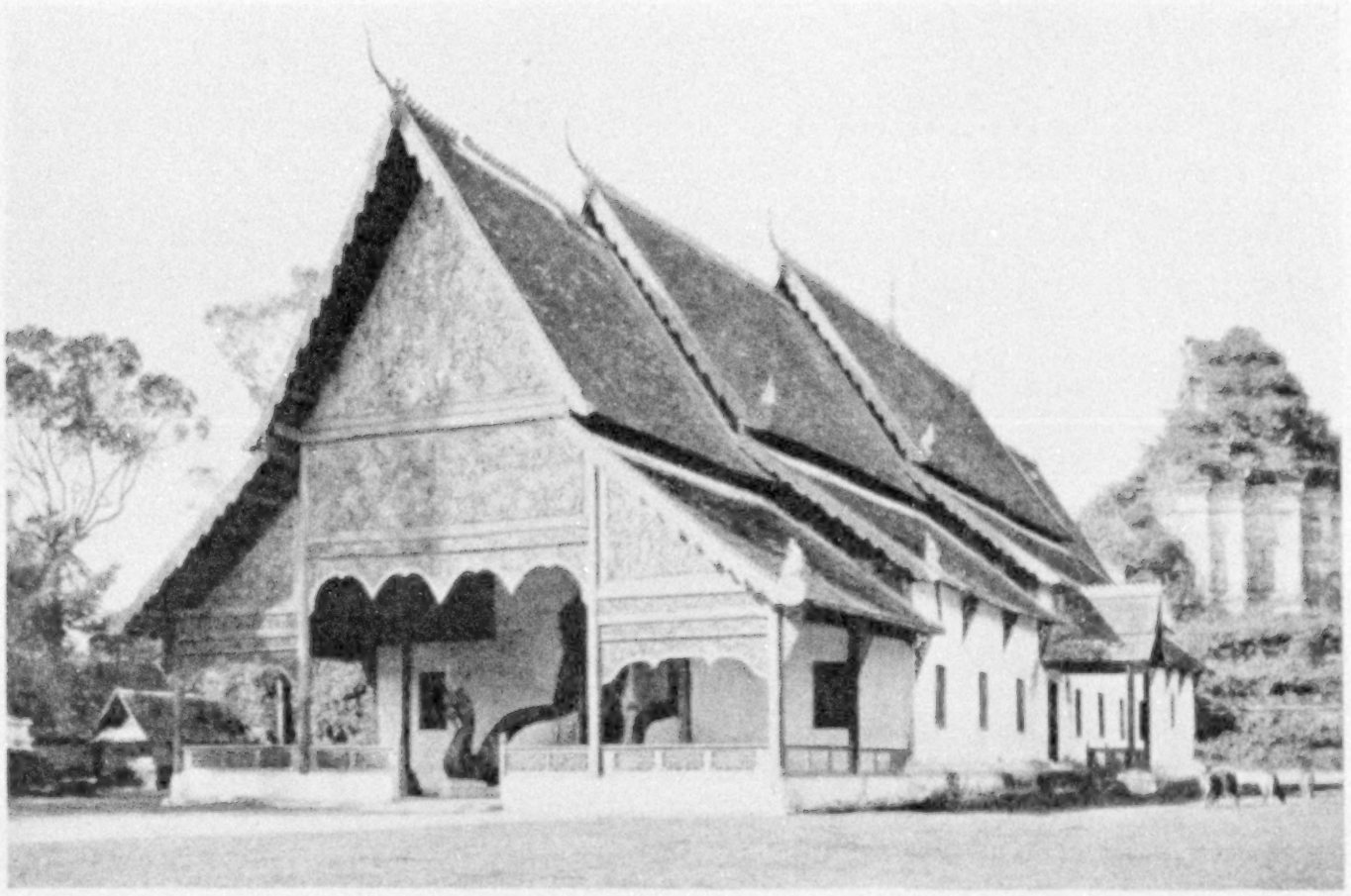
Before reaching Muang Hawt, the largest village between Chiengmai and Ban Nar, we passed steep cliffs known as Pa Wing Choo. Here legend says that Princess Rata, escaping with her lover from her father, leaped over the mighty precipice on horseback. Their bodies were recovered at Muang En, and farther down various articles of the horse's equipment were found at the different rapids which have been named accordingly, as Pa Morn (Saddle found), etc.

The village of Muang Hawt consists of a single street with mud and bamboo houses, the inhabitants of which were lined up by the headman of the village to be photographed.

The river at this season being low, it was difficult to make a landing. We tarried only long enough to dispose of many bags of rice, the cause of our constant grounding on sand banks. Once I lost patience and, being in negligée, I quietly jumped overboard and swam ahead of the boat, expecting it to follow soon. Anxious calls from the captain urged me to return to the boat, quite a difficult matter against the current. The waters, I learned afterward, are said to be infested with crocodiles.

QUEER APPETITES OF A LAO CREW

After passing through the beautiful defile of Fa Man, with its wall of red rock, we approached the rapids (see page 265). Here we found a number of teak logs high and dry on a huge boulder in the middle of the stream, where they had been deposited by the receding waters. The scenery now became gorgeous. Steep walls covered with verdure and densely forested banks, on which bamboos of



THE CARVED TEAK-WOOD FACADE OF WAT LUANG, CHIENGMAI'S CHIEF TEMPLE

This sacred edifice was built only forty years ago on the site of an earlier temple (see text, page 245).

THE LIBRARY IN THE TEMPLE GROUNDS OF WAT LUANG: CHIENGMAI

Among the Siamese of Chiengmai the only merit in books is in their writing. The tomes are placed in libraries which might more properly be termed literary mausoleums, for the volumes are seldom, if ever, read (see text, page 249).

enormous height formed the main vegetation, glided past in review.

Rapid after rapid was negotiated, 41 in all, requiring two days. The first large one was Keng Soi, and the second Omlu, where the river made two wide curves, forming the letter "S." To my mind, this was the most dangerous of all. After passing the whirlpools we stopped and I went back, followed by my crew, to a few natives who had been fishing along this rapid. Instead of buying fresh fish, my men bought the oldest and rottenest they could find. This made further residence on my boat next to impossible, and I energetically demanded the removal of the offensive fish. They were eaten post haste.

At Okma, one of the last rapids, we met with difficulties that necessitated our being let over by means of ropes. At the first trial these broke, so that we narrowly escaped being dashed against the rocks.

ASHES OF ROASTED GIBBONS USED AS CONSUMPTION REMEDY

The only life observed along this tortuous river was an occasional bird with black-and-white plumage, at which the Lao boys dexterously shot with bow and pebbles. Here and there a gibbon ventured to the river bank, but not a single sambar did we observe, although they are common in this region. My interpreter informed me that the Lao and Siamese roast or burn gibbons, and the ashes are taken with liquor as a remedy for consumption. Everything is used—entrails, hair, and all.

Our next camp was near Pa Khar, where elephants kept me awake during the night. They were only breaking bamboo for food, but the noise resembled machine-gun fire.

Early in the morning I climbed the hillside to collect botanical specimens, but I was soon forced to retreat, owing to the unexpected appearance of a bear. The whole hillside is one solid mass of gray rock. A few hundred feet above the level of the river I found water-worn rocks, with deep, smooth holes, formed thousands of years ago by the waters of the Meh Ping. In these holes, trees (*Euphorbia antiquorum*) are now growing.

At Kaw Paw Luang we reached the last of the rapids. To the right was a huge rock, Doi Chung Da, with a cave of three entrances, each pointing in a different direction.

A fleeting visit was paid to (Kaw) Sam Gnow, "The Three Shadows," where an altar is hewn into the hillside some distance from the river. Here, in three niches, three Buddhas sit enthroned, in memory of three sacred shadows which appeared as an apparition to early navigators of the stream (see page 267).

Finally Raheng came into sight, and I parted from my cheerful Lao captain and crew, who had so faithfully and efficiently guided our boat through treacherous rapids.

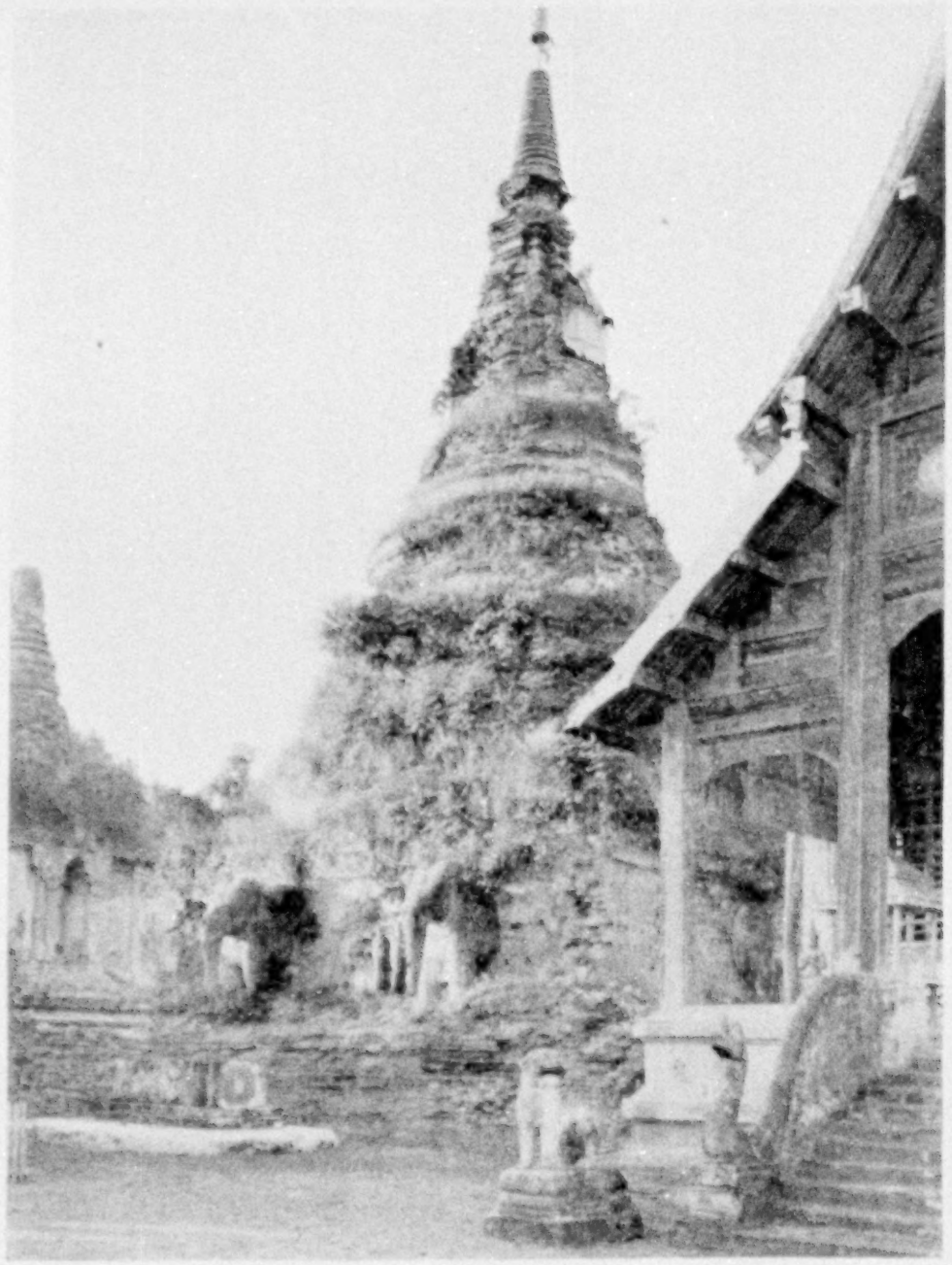
The hardest part of the Siamese journey was now before me. With the help of the Assistant Governor of Raheng we completed our preparations and crossed the river, only to learn on the other side that we had more baggage than carriers, and so again we had to cross to the Borneo Company Compound to spend the night and wait for another contingent of coolies.

After reaching Raheng, we crossed glorious mountain ranges, covered with dense tropical forests of trees 150 or more feet in height, under whose protecting crowns we spent the nights. Sometimes we did not sleep with a sense of security, for these regions are inhabited by tigers, leopards, and snakes.

The scenery varied greatly. We traversed regions in which teak, strychnos, and cassia trees abounded; then we plunged through bamboo forests; then passed over mountain ranges covered with oaks, till finally we descended again into the plains, and after a journey of seven days reached Mesawt, a small town, the last Siamese hamlet, near a branch of the Salwin River.

A COURT FOR THE TRIAL OF ELEPHANT THIEVES

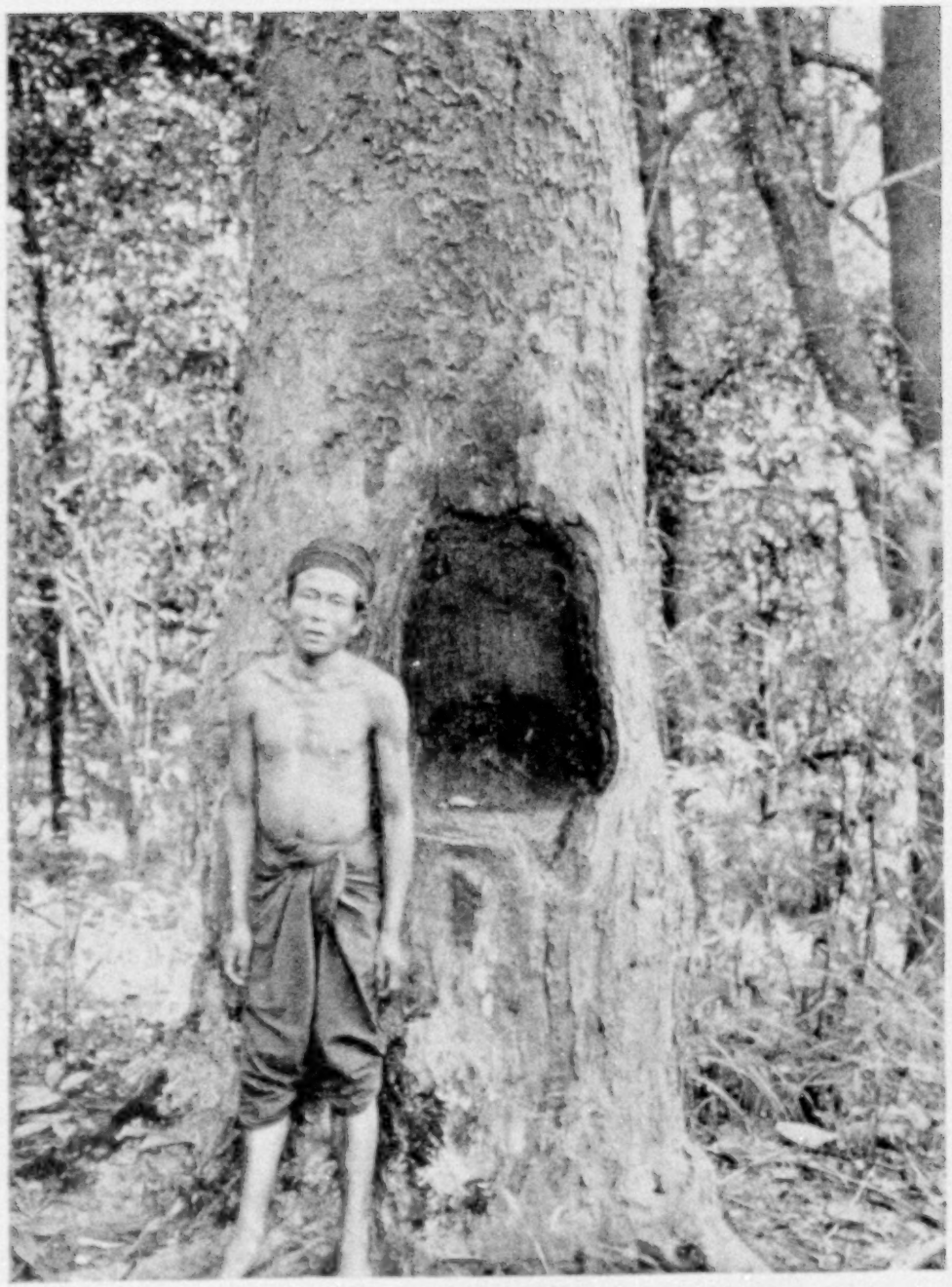
When I called on the governor of Mesawt he was holding court for the trial of elephant thieves, who carry on a prosperous business near the border. The elephants are easily stolen, as they march very quietly, and once over the Burmese border are gone for good. Leaving his chained prisoners sitting on the floor, the magistrate accompanied me to the rest-



THE ELEPHANT VOTIVE SPIRE AND THE ENTRANCE TO THE GROUNDS OF WAT PHRA SING, IN CHIENGMAI

The Chiengmai temples are rarely repaired; hence vegetation runs riot over them after rains and winds have started their work of destruction. At the right is a portion of the building in which priests take their vows (see text, page 249).

The approach to the temple, which is in a bad state of repair, is guarded by two leogryphs of brick and mortar (see illustration to the left). Of the eighty temples of Chiengmai, this is second in importance only to Wat Luang.



THE TRUNK OF A MAI YANG TREE (SEE TEXT, PAGE 245)

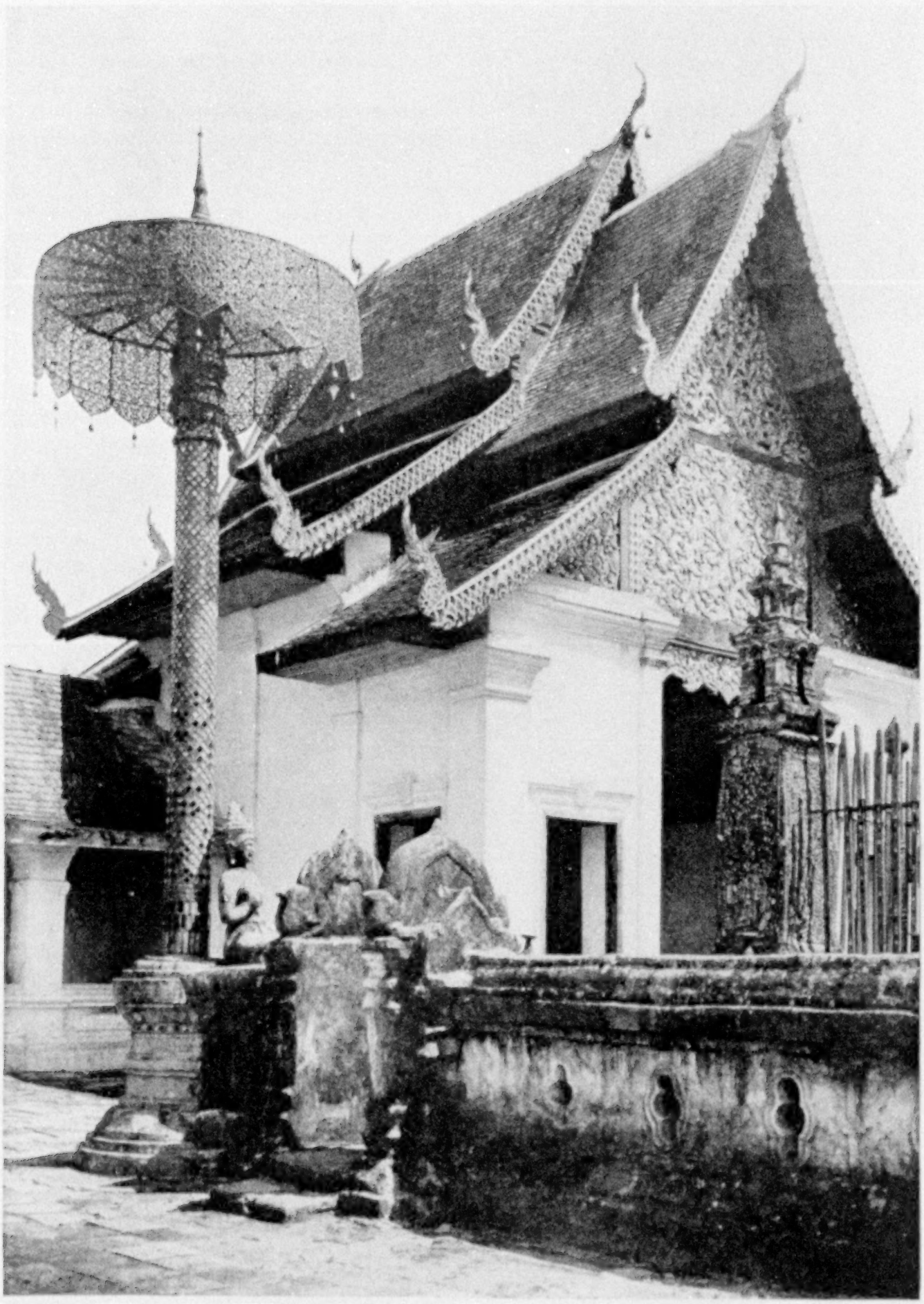
The natives burn holes in these trees to collect a resin which they use in lamps. Nearly every Mai Yang tree is thus mutilated. The road from Lampun to Chiengmai runs through beautiful groves of these trees.

A FICUS TREE IN NORTHERN SIAM COVERED WITH FERNS

The northwestern slopes of Doi Sootep (see text, page 249) have a different climate from the slopes to the southeast. The former are clothed with tropical rain forests.

THE BUDDHA OF WAT DOI SOOTEP, OF BRICK STUCCO AND HEAVILY GILDED

The approach to the temple is through columns of pines festooned with orchids (see text, page 254).



WAT DOI SOOTEP, SITUATED ON A MOUNTAIN OF THAT NAME, 3,000 FEET IN HEIGHT

From this temple a glorious view is obtained over the Meh Ping Valley and the city of Chiengmai (see page 254).

A KARENI OF THE JUNGLE VILLAGE OF OKTADA, IN THE MARTABAN HILLS

This native of Burma holds in his hand some of the fruits of the Kalaw tree (*Hydnocarpus castanea*), similar to the true Chaulmoogra.

house where Siamese officials stop when en route from Raheng.

I decided to take to Burma the pony, which the Governor of Raheng had rented me, as the roads are very rocky and walking very uncomfortable. All my coolies, 24 in number, were paid off except two, my horseboy and my camera-bearer and treasurer, who carried all the heavy silver rupees. Neither paper nor nickel is negotiable in this part of the world.

For my heavy baggage and specimens I hired three bullock carts with Burmese drivers. These carts make from 18 to 20 miles a day.

After swimming a branch of the Salwin, traveling was more comfortable, as the British Government furnishes dak bungalows for the convenience of traveling officials and other Caucasian wayfarers.

THE FIRST GLIMPSE OF A CHAULMOOGRA-OIL TREE

Our path lay across the Kawkereik Hills, which are covered with glorious verdure, and it was in this region that I first encountered *Taraktogenos Kurzii*. Unfortunately, it was not in fruit. I was informed by a Burmese village quack that July is the month in which the Chaulmoogra fruits ripen. We hurried on and finally reached decadent but beautiful Moulmein on Christmas eve.

At first I deplored not having stopped for Christmas in the jungle! Yet in the end I was glad, for Christmas day was spent in the delightful company of our American missionaries at Moulmein.

They are doing a great work among the Burmese boys and girls and also among the lepers, though the institution for the latter leaves much to be desired.

My next point of venture was the Kalama range of the Martaban Hills, where the natives said Kalaw, or *Taraktogenos Kurzii*, could be found. So with interpreter, cook, and boy I started by train to Paung, on the road between Moulmein and Rangoon, and thence by bullock cart to the small Kareni village of Oktada.

To avoid mangy dogs and ticks, we made our camp under an old mango tree on the outskirts of the village, on the edge of the jungle, despite the fact that my companions swore that the woods were infested with tigers and other wild animals. I decided to sleep under the tree and my men arranged themselves around my cot.

The following day was devoted to ex-

ploring the hills. The mountains rise abruptly from the plain, are strewn with huge boulders, and are intersected by numerous rocky creeks on whose banks grows a species of *Hydnocarpus*, later identified as *H. castanea*, and called by the natives Kalaw, but it was not the long-sought-for *Taraktogenos Kurzii*. The seeds of these two trees are so similar that it would be impossible to tell them apart were it not for the double testa of the former.

IN THE HAUNTS OF TIGERS

I made a last trip into the hills of Oktada and found that Mr. Shwaloo, my interpreter, was correct as to the presence of tigers, for there were fresh tracks leading not far from our camp to the top of the ridge. Only a few hours before the big cat had stalked over the sandy trail to his haunts in the dense, low, bamboo forest, which we had to penetrate in a bent position in order to reach the Kalaw trees.

In all our rambles for three days we found only one tree with some 170 mature fruits, which I secured and the seeds of which I forwarded to America, where they are now growing. Although the seeds of this species have not been chemically examined, it is possible that they contain the same active constituents as the genuine Chaulmoogra.

Determined to secure *Taraktogenos Kurzii*, I left for Rangoon to inquire of the government forest office whether any of its staff knew where the tree could be found. The upper Chindwin District was said to be the home of the genuine Chaulmoogra tree. So I started once more with a Madrassi cook and a Mohammedan boy, this time by train, for Amarapura, where we crossed the Irrawaddy to Sagaing, and thence by train over a semi-desert region to dusty, dirty Monywa, on the upper Chindwin River.

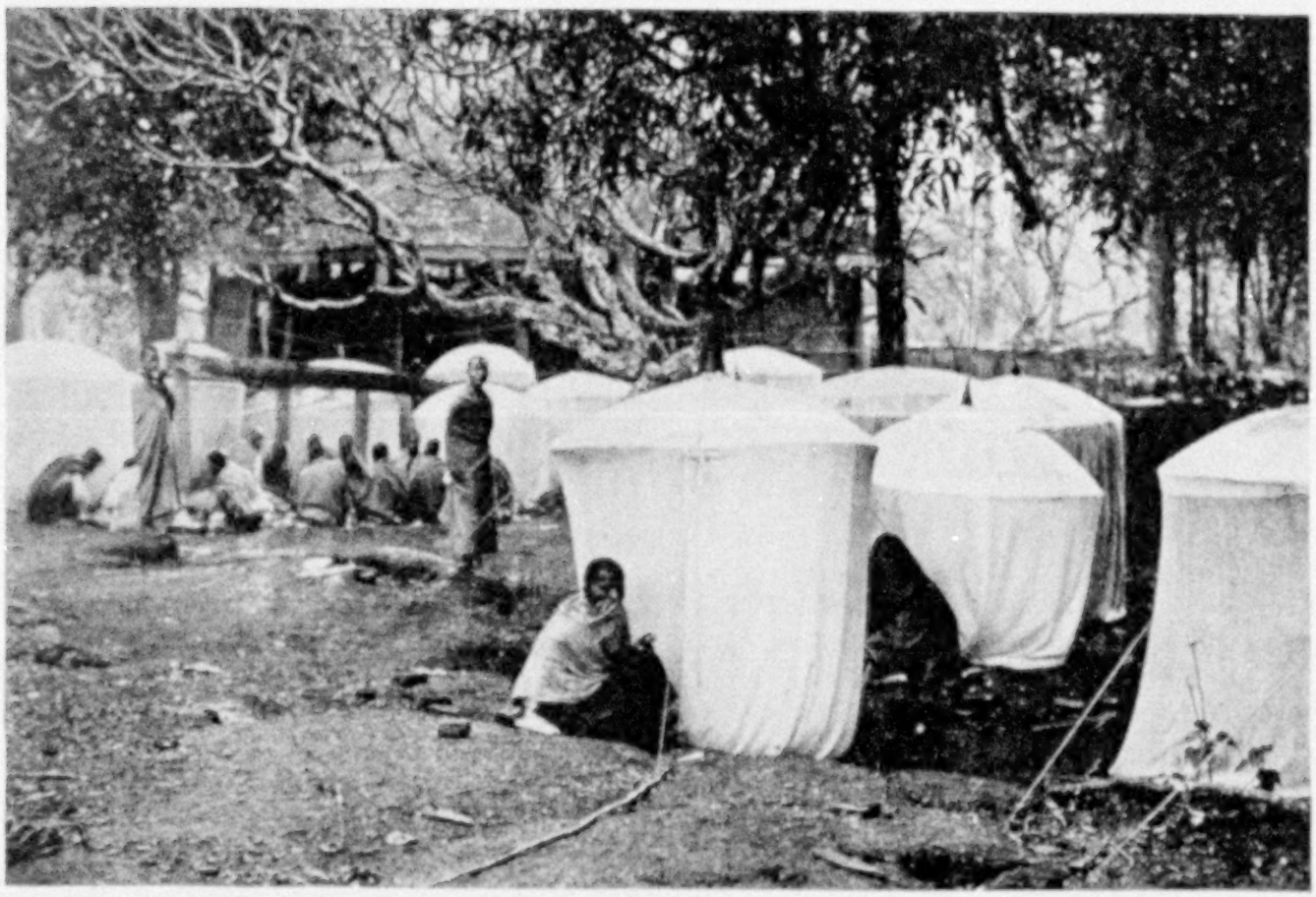
MONYWA, TOWN OF DUST AND FLIES

Monywa, what a dreadful place! Dust, dust, dust, several feet deep, and the bullock carts conveying my luggage from the railway station to the *Shillong*, a trim stern-wheeler, were hardly visible in the alkaline clouds stirred up by clumsy feet. Kalaw seed is here sold in the bazaars, but I was told that it came down "from the north."

SHE'S RAISING HER SON TO BE AN ACTOR

This child, whose mother is a Siamese and whose father is a Chinese, wears the headgear of a Siamese Thespian (see also p. 245).

The bazaar is a living entomological collection. Never, not even in Egypt, have I seen flies so numerous. They cover the conical piles of brown sugar spread out on mats on the ground to such an

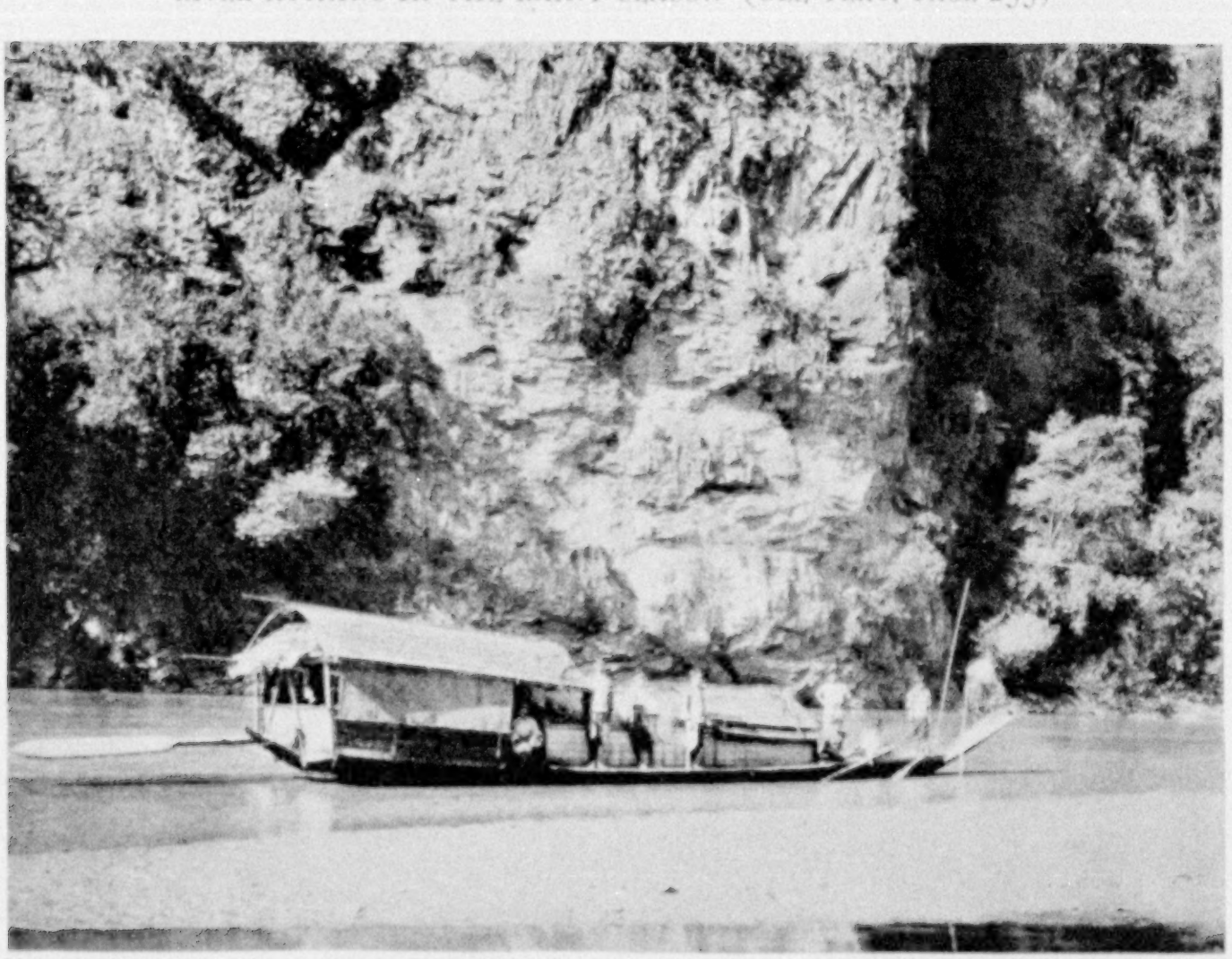


MOSQUITO TENTS USED BY BUDDHIST PRIESTS AS SLEEPING QUARTERS WHEN THEY TRAVEL IN NORTHERN SIAM

EXAMPLES OF THE METAL-WORK OF THE PEOPLE OF THE LAO STATES: SIAM

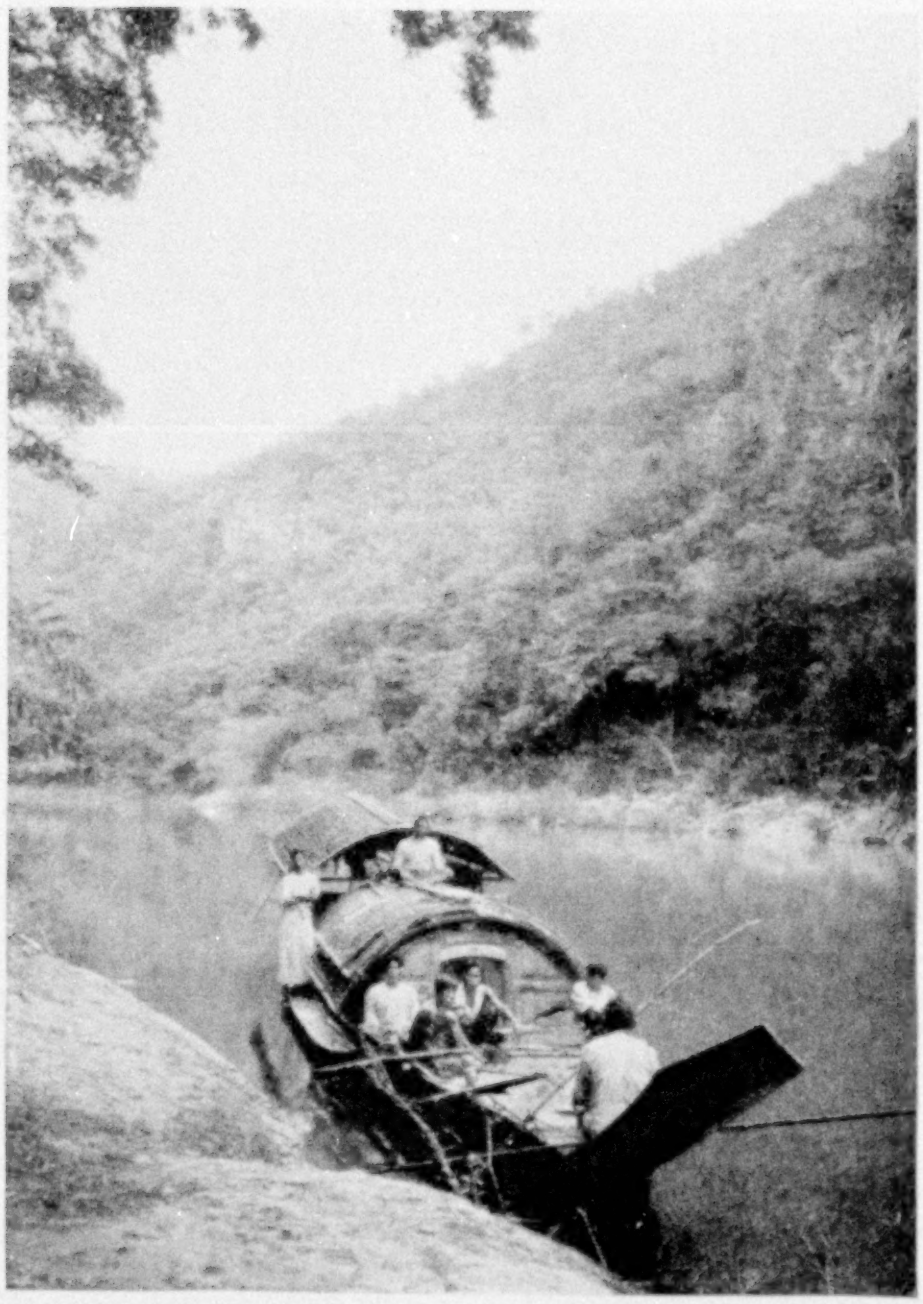
These Lao ladies, expert in the manufacture of silver bowls and baskets here displayed, are seated at the feet of the American Minister to Siam.

TEAK LOGS STRANDED ON A ROCK IN THE MEH PING, SHOWING THE HEIGHT THE RIVER ATTAINS IN THE RAINY SEASON (SEE TEXT, PAGE 255)



A LAO HOUSE-BOAT ANCHORED IN THE MEH PING

Here are seen the towering cliffs of red rock through which the river has cut its way at the defile known as Fa Man. The commodious craft on which the author traveled was manned by a Lao crew, an interpreter, a cook, and a boy (see text, page 255).



AWAITING THE RETURN OF THE EXPLORER FROM A TRIP INTO THE HILLS (SEE TEXT, PAGE 255)

The Lao captain of this house-boat on the Meh Ping waits patiently on the roof of his craft.

extent that almost every grain is moving, and this in the midst of squatting, betel-nut chewing, and expectorating women, surrounded by the mangiest fighting dogs, rotten tomatoes, cauliflower, cabbages, and cucurbits.

Early next day we left Monywa, and it was a comfort to be on a clean boat and on a picturesque river.

In the mornings we made little progress, due to fog which hovered over the river sometimes until 11 o'clock. The river was quite low at this season (January), and as the channel changes considerably, navigation is carried on with difficulty. We learned of one boat being aground somewhere up the river and we were to help it into deeper water, but unluckily we, too, became stranded on a sand bank. All the third-class passengers were promptly taken ashore in rowboats, and after an hour or so, when the boat was free, they were again brought on board.

What a scramble up the steep bank of the river, the level of which was then fifty feet lower than during the rainy season.

LIFE ON A BURMESE RIVER

Against the gray background of mud the gaily colored costumes of the Burmese men and women were wonderfully picturesque. There were deep purples, green, light blue, yellow, dark gray, and light pinks, with an occasional somber yellowish-brown denoting a shaven priest.

Many a peculiar craft passed the *Shillong*. A raft came floating down the river with people rowing at the four corners and a house in the center, with a flagstaff made of a living tree, from which fluttered a red and white pennant. Next we overtook a big house-boat poling up the river. It resembled a Chinese junk, about forty-five feet high at the stern, with a small bridge and a roof. There was one mast in front, the bow was forked and painted yellow, and it had a long bamboo cabin in the center.

We halted at Kalewa, a bazaar town prettily situated on an elevated tongue of land at the junction of the Myttha and the Chindwin. The one street runs along a ridge which culminates in a commanding eminence crowned with palms and pagodas. High peaks rise around Kalewa, whence starts the famous 60-mile Chinhill

SAM GNOW, OR THE THREE SHADOWS OF BUDDHA

This place of pilgrimage, near Raheng, on the Meh Ping River, is an altar hewn into the hillside. In three niches sit three Buddhas in memory of three sacred shadows which appeared as an apparition to early navigators of the stream (see text, page 257).

road to Fort White, which is garrisoned by Sepoys.

At length we arrived in Mawlaik, the new government seat of the upper Chindwin District, Kindat having been abandoned about three years previously, owing to malaria and unhealthy surroundings.

Mawlaik, newly laid out, possesses a circuit-house the like of which is found nowhere in Burma. It is a comfortable building with spacious verandas overlooking the Chindwin and the jungle on the opposite side of the river. The hospital, with its modern equipment, would be a credit to any American city.

Here I was informed that the Chaulmoogra forests were to be found several days' journey from Mawlaik.

Provided with a Burmese letter addressed to the tajees or headmen of the various jungle villages through which I was to pass, I started down the Chindwin in a dugout canoe.

CHAULMOOGRA TREES, BUT NO FRUIT!

After rowing for an hour through fog, I met a tajee in a boat coming upstream. We hailed him, and after seeing my magic letter he returned at once to his village, where he obtained peasants to carry my kit. A string of coolies, some twenty or more, mostly women with naked children on their hips and backs, and botanical blotters, a cot, or whatever they happened to pick out, balanced on their heads, marched through dale and over hill for the mere pittance of one anna (two cents or less) a mile.

After two days' marching through dense forest and crossing the Khodan

A MODERN STERN-WHEELER ON THE UPPER CHINDWIN RIVER (SEE MAP, PAGE 242)

This is the *Shillong*, which brought the author to Mawlaik, from which point he began his successful hunt for the Chaulmoogra trees in the jungles near haunted Kyokta.

stream many times, we reached Khoung Kyew. Here I found my first genuine Chaulmoogra tree, some miles distant from the village proper. Wild elephants live in herds in these jungles and often come to bathe in the stream in the daytime. First we entered a dense Dipterocarpus forest, then one of bamboo (*Cephalostachyum pergracile*), and finally we reached pure stands of the genuine Chaulmoogra tree, *Taraktogenos Kurzii* (see page 269); but, alas, no fruit!

The headman of the village informed me that there had been a very poor crop of seed here, but added that a village some miles farther had had a very good one the year before, and so I decided to proceed thither.

I sent my magic piece of paper ahead by special messenger, and when I arrived at Kyokta, the village in question, I found a bamboo mat spread in the village square near the Poongyi Khoung, or little pagoda, with an old and only chair in the center and the peasants sitting around the mat.

I made myself as comfortable as possible in my little camp on the edge of the jungle, for this village is surrounded on three sides by dense forest. The next day I started out with 36 coolies, determined to come back to camp loaded with Chaulmoogra seeds. We had five or six miles to walk, always following a dry creek bed through the dense forest. These creek beds are as flat as a floor, with no rocks visible. For miles there was only fine quartz sand, which made marching easy.

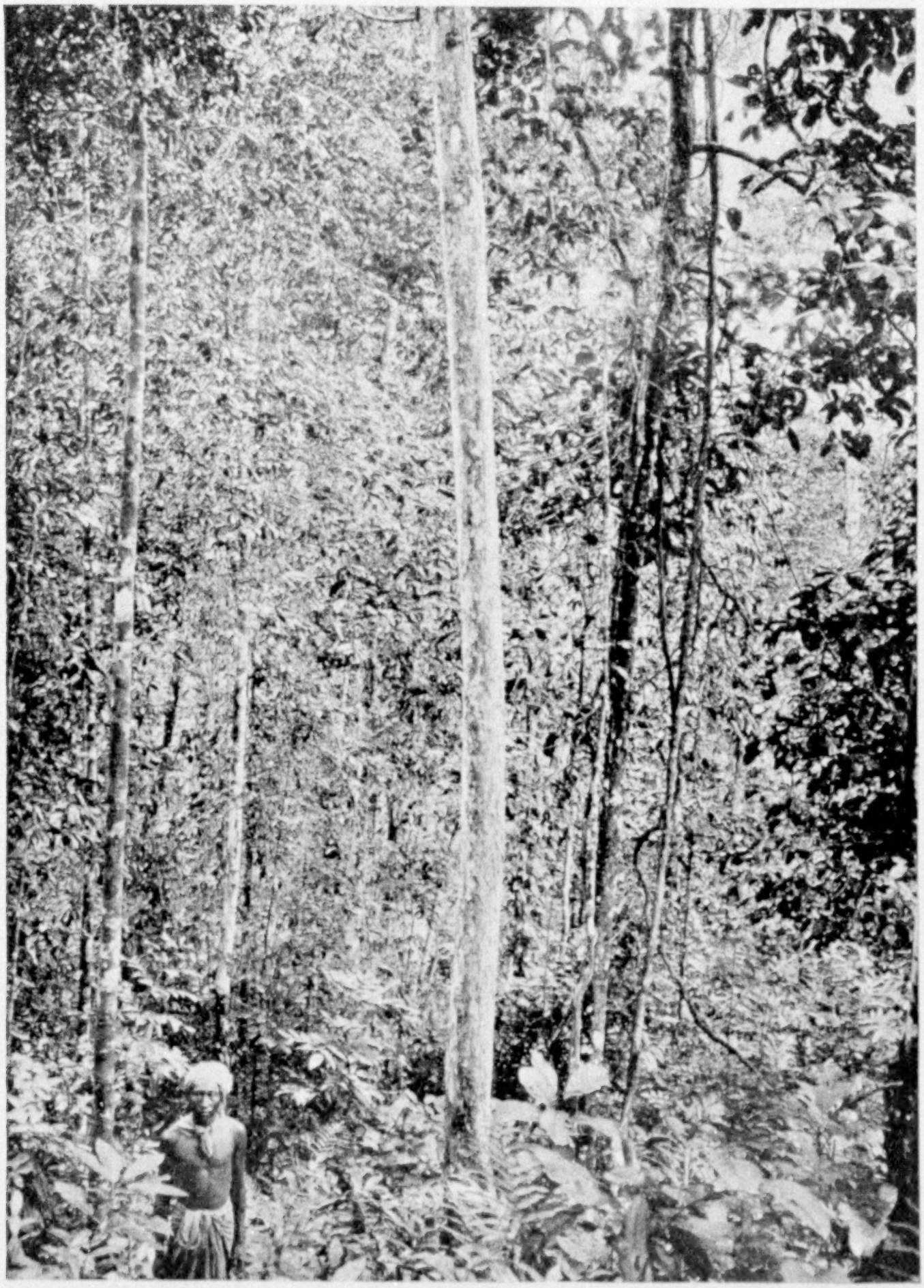
We passed through vegetation similar to that at Khoung Kyew until we struck the Chaulmoogra forests. There we separated into smaller parties and the seed-collecting began in earnest (see page 270).

While thus engaged we met a mother bear with her cub. With wild shouts from the natives she was driven off, leaving behind her young, which my Burmese coolies insisted on taking to the village.

THE LEPROSY-CURING SEED AT LAST

Loaded with seeds, we started down the steep hillsides, which are covered with Chaulmoogra trees, glad at heart that at last I had been successful.

When we reached the stream bed up which we had come a few hours previ-



PURE STANDS OF CHAULMOOGRA TREES NEAR THE JUNGLE VILLAGE OF KHOUNG KYEW: NORTHWESTERN BURMA

This forest is tenanted by wild elephants who often come to bathe in the Khodan stream in the daytime. At the time of the visit of the author, these trees were not in fruit, so he proceeded a few miles farther to Kyokta, where his search for the precious oil-bearing seeds was finally rewarded (see text, page 268).

IN THE MIDST OF A CHAULMOOGRA FOREST

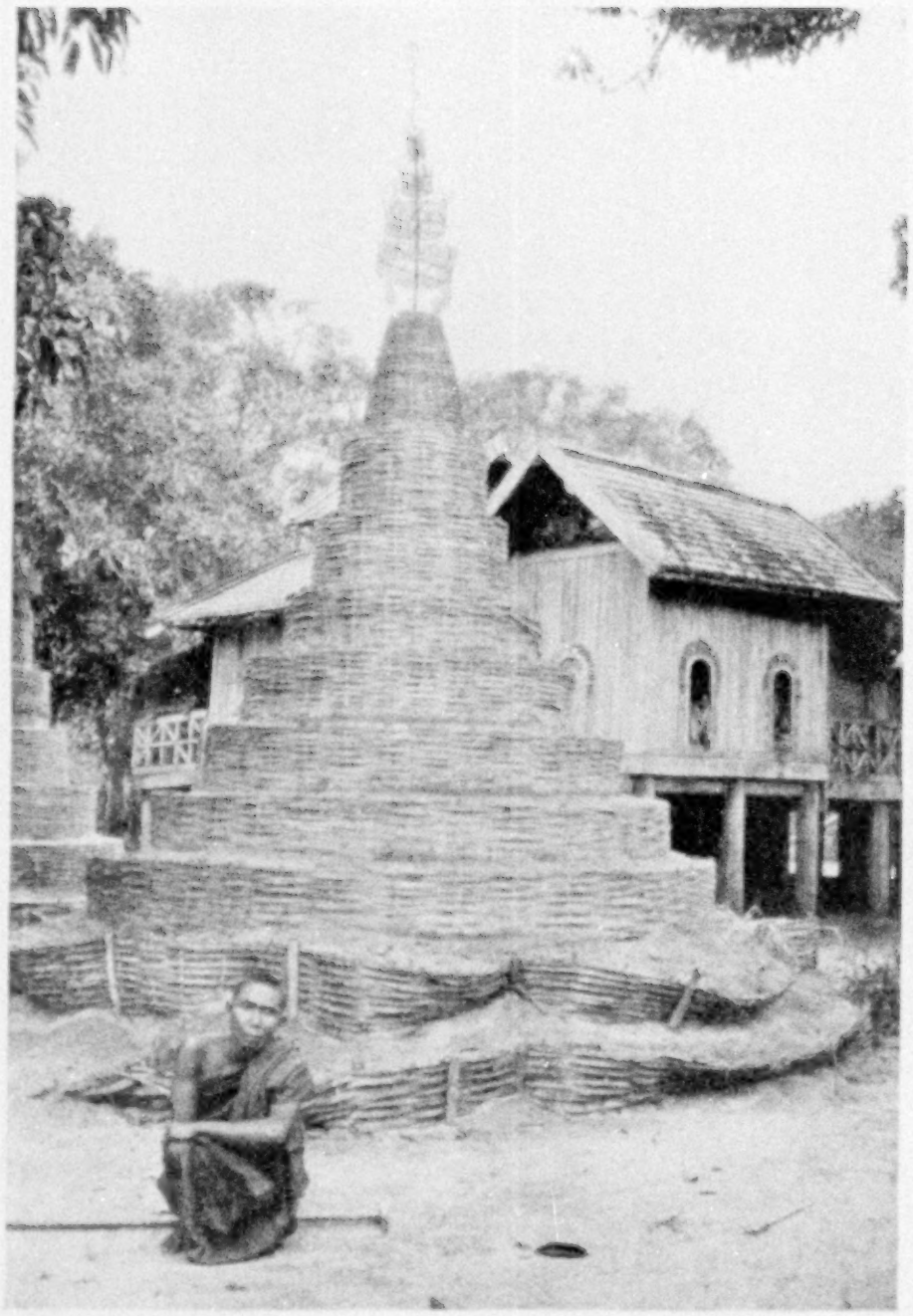
Along a creek bed near the jungle village of Kyokta, in northwestern Burma (see text, page 268).

THE SOURCE OF THE PANACEA FOR LEPROSY

A fruiting branch of a genuine Chaulmoogra-oil tree pinned against the trunk of the tree itself.

SAVAGE FOOTPRINTS IN THE SANDS, PROOF THAT DEATH HAD STALKED THE SEED HUNTER

On his return from the Chaulmoogra forests to the creek bed which he had followed in the morning, the author found unmistakable signs that a tiger had stalked his party for several miles (see text, page 273).



THE VILLAGE PRIEST OF KYOKTA IN FRONT OF A PAGODA MADE OF SAND AND BRAIDED BAMBOO

During the night of the wild elephant attack and the capture of the tiger (see text, page 276), the author slept in the teak-wood temple, the safest place in the village.

THE TRAP BUILT FOR THE TIGER AND BAITED WITH ONE OF ITS HUMAN VICTIMS

The whole village of Kyokta worked with feverish haste to complete the trap before nightfall. The body of the woman was separated from the main trap by stout bamboo stakes (see text, page 276).

THE SLAYER SLAIN

Twenty spear thrusts ended the existence of this savage beast.

THE END OF A WOMAN EATER (SEE TEXT, PAGE 276)

The beast which had wrought such destruction was borne to the village square to be skinned.

ously, we found that a large tiger had followed us into the jungle, for there were its footprints so clear and distinct that I stopped and photographed them (see page 271). We had no arms with us; only a camera and quantities of Chaulmoogra seeds.

We reached the village safely, and I immediately began to pack my seeds in powdered charcoal and oil paper to prevent the moisture from escaping; for when allowed to dry out they lose their germinating power within a short time.

I had planned to begin the return journey to Mawlaik with my precious burden the next day; but I had reckoned without the tiger. Two of my coolies had a small rice field only a quarter of a mile distant, in the jungle, with a small hut in which their children and womenfolk slept and guarded their harvested grain. Instead of returning that evening to their hut, they remained in the village, leaving their womenfolk alone in the field.

THE TIGER TAKES TOLL OF THE PEASANTS

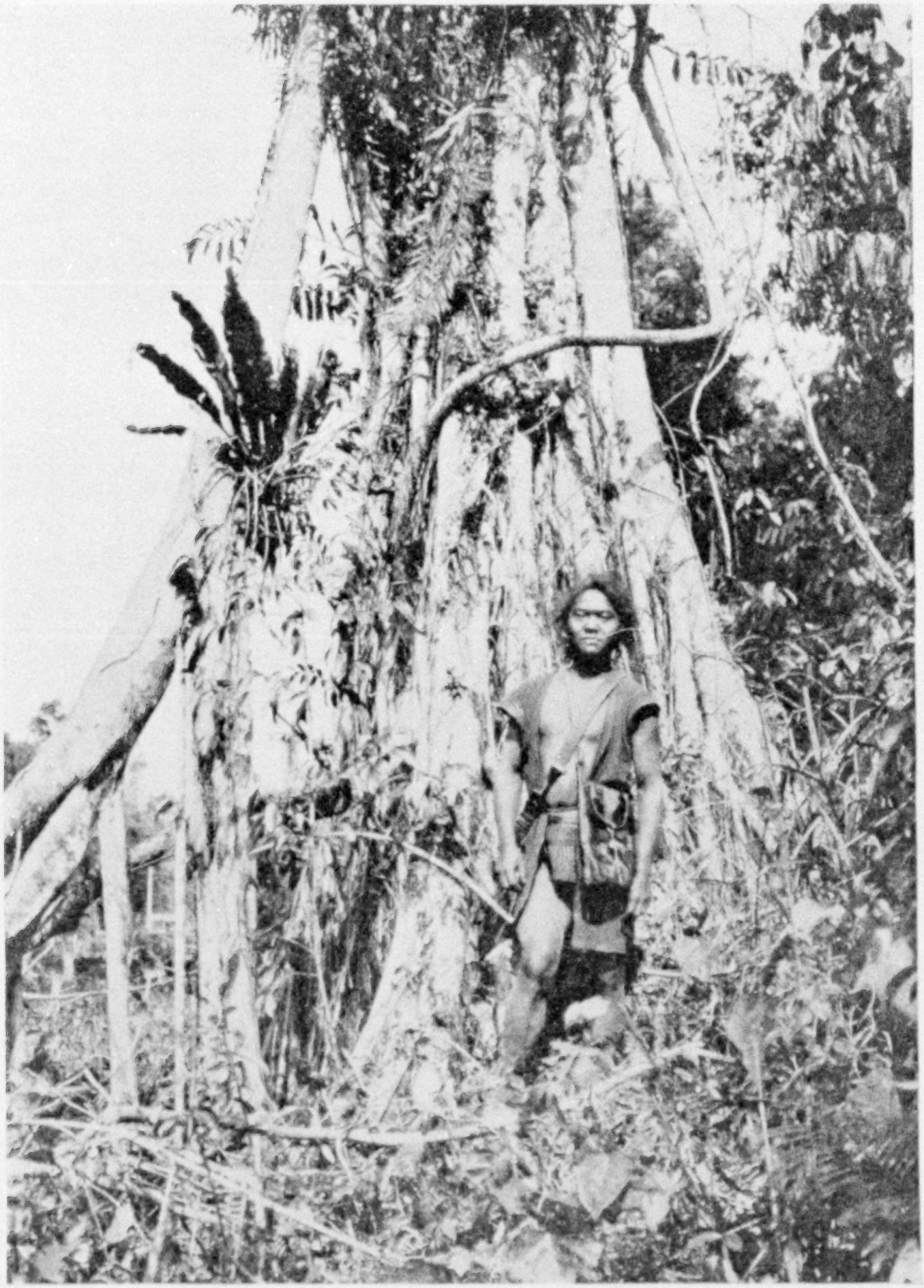
At 6 o'clock the next morning, as I was about to start and the coolies were ready to take their burdens, the tajee (headman) came to me with a very sad face and still sadder story, saying that a boy five years old had come from the outlying paddy-field, reporting that his mother had been killed by a tiger. The poor youngster was himself badly injured, showing the scars of five claws on his back and his left lower limb badly burned from a campfire into which the tiger had hurled him.

Great excitement ran through the village. The temple drums were beaten and the gongs sounded an alarm. All the male villagers armed themselves with spears and knives and, marching ahead of them, I went to the scene of a tragedy.

A dreadful spectacle awaited me. Into this lonesome place, wrested from the jungle, the tiger came at dawn to do its work of destruction. We found that, owing to the cold night, the women, living with two children, had constructed a hut of paddy or rice straw directly on the ground, with only one small opening. In this hut were three women, a two-year-old girl, and the five-year-old boy. When the tiger had entered the hut, there was no escape. Short work was made of the helpless victims.

MEMBERS OF THE JUNGLE TRIBE OF MISHMI, IN THE FORESTS OF NORTHERN ASSAM

After finding the Chaulmoogra trees in northern Burma, the author proceeded to Calcutta and thence to Dibrugarh, Assam, where Chaulmoogra trees were also found, as well as these interesting people.



A MISHMI IN THE DIBRU FOREST AT THE FOOT OF A HUGE FICUS TREE: ASSAM

The true Chaulmoogra-oil tree is found only as scattered individuals in Assam, growing in company with the *Gynocardia odorata*, a tree belonging to the same family and for more than a century thought to have been the source of Chaulmoogra oil.

One woman, about 25 years old, was lying about 100 yards away from the hut, whither she had been dragged by the brute, her face literally bitten out and her neck severed. The second woman was lying in the hut, a formless, gory mass, and the third lay in front of the hut, alive but with a ghastly face wound, her whole left cheek having been bitten out, exposing both jaws.

The little girl had disappeared. All we found was a trail of blood which led into the forest.

I had a litter of bamboo constructed, on which the injured woman was taken to the village, where I dressed her wounds.

BAITING A TIGER TRAP WITH A HUMAN VICTIM

But what was to be done about the tiger? We had no arms save a Colt automatic, so we decided to build a trap. I shall never forget how the poor husbands of the slain women worked on that trap. One had lost all his family—his wife, sister, and little daughter.

The whole village worked all afternoon constructing the trap, into which was placed for bait the body of the woman found in the field. She was separated from the main trap by strong bamboo stakes and her hands were tied with a string which was fastened to the drop-door of the entrance (see illustrations, page 272).

For safety the village priest invited me to spend the night in the little wooden temple at the feet of Buddha. To sleep was unthinkable. It began to rain, the thunder rolled, and weird lightning effects added height to the somber monarchs of the forest. Crash followed crash and—what! listen!—the trampling and trumpeting of elephants, wild cries and shouts of confusion!

I did not know till next morning what had happened. A herd of wild elephants ventured to the outskirts of this doomed village and made short work of the flimsy houses and rice barns. Like a cyclone, they swept over the place and, not satisfied with destroying the huts, devoured the recently harvested rice. The morning found the sky still weeping over all this tragedy.

But the tiger had been caught, and I was informed that the men were sitting around the trap waiting for me. I hurried to the scene, following the tiger's still visible imprints of the day before on the sandy banks of the stream. The captured creature's rage was terrible to behold. Only a few minutes and the brute was no more, for 20 spears ended its savage existence.

On opening the trap we found that the animal had severed the bamboo separating it from the body of its victim and devoured the latter—hair, head, and all—save a small portion of her back. We gathered the few remains and buried them in the rice field. The natives carried the tiger on two bamboo poles to the village (see page 273).

I left Kyokta that afternoon, in spite of rain and the advanced hour of the day. The forest looked still more somber and weird; the trip back was not a pleasant one, for we had with us the injured woman, whom we were taking to Mawlaik, where she died the day after our arrival.

The dearly bought Chaulmoogra seeds were shipped from Mawlaik to America, where they are now growing and ready to be transplanted.

THE DEMAND IS FAR GREATER THAN THE PRESENT-DAY SUPPLY

In conclusion, it may be stated that the ethyl esters manufactured in Hawaii are unfortunately only sufficient for treatment of lepers in Hawaii. In fact, there are several hundred patients in Hawaii still untreated. No help from Hawaii can be promised to lepers residing outside of that territory and no medicaments can be secured from the territory at present.

These leprosy specifics are now manufactured by several firms, but not in quantities large enough to supply the world. This can only be accomplished by growing the trees as a plantation crop.

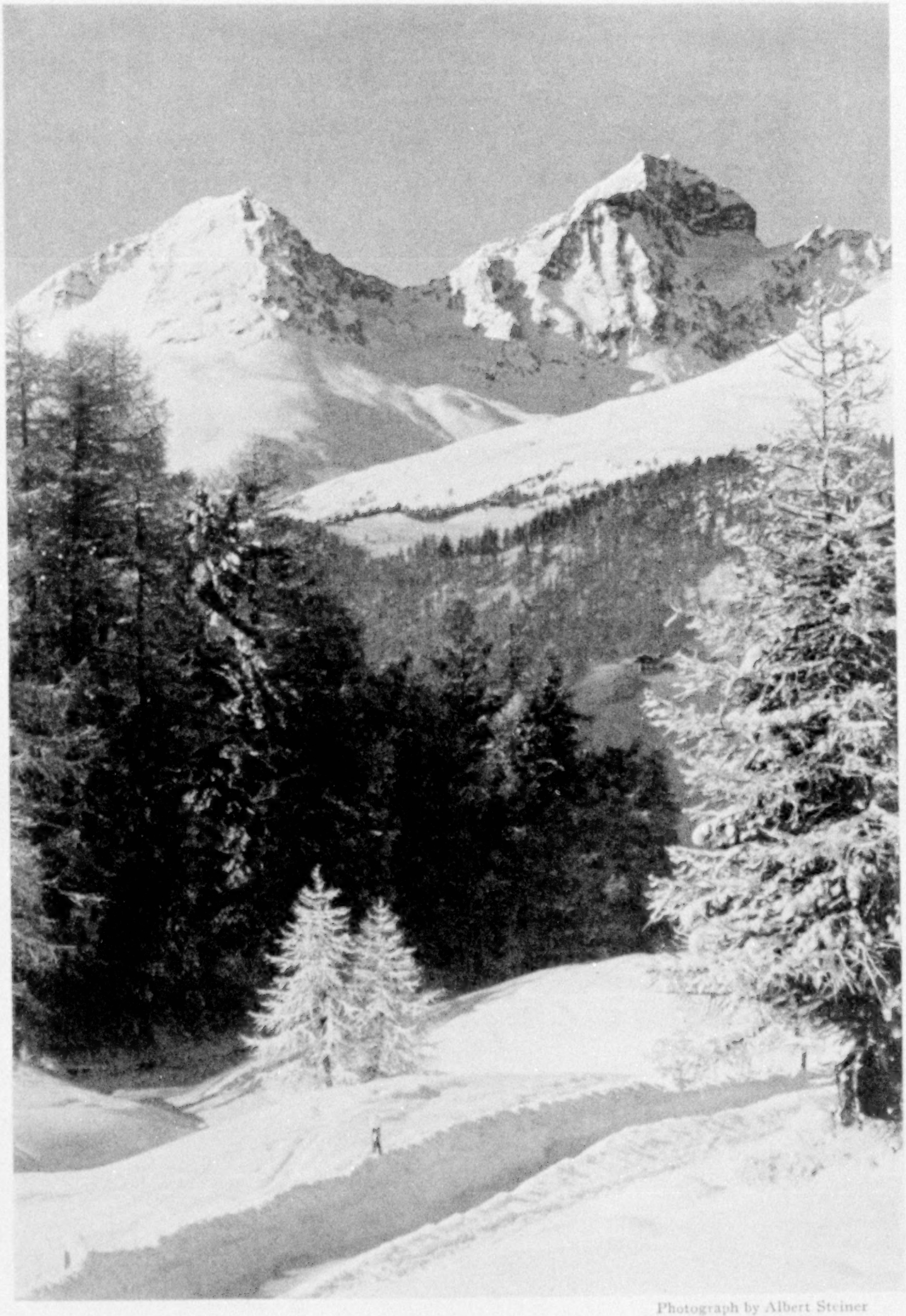
Hawaii has taken the lead in the establishment of a Chaulmoogra plantation, but it must be remembered that it will be at least eight years before these trees produce fruit.

XUM

Photograph by Albert Steiner

A WINTER LANDSCAPE NEAR ST. MORITZ

"Nine months winter and three months cold" is the phrase the natives of the Upper Engadine region of Switzerland employ in describing their climate, which attracts summer tourists from June to September, and winter revelers from November to March.



Photograph by Albert Steiner

WHEN WINTER DECORATES THE ALPINE SLOPES NEAR CAMPFÈR

Campfèr is situated at the mouth of the Suvretta Valley and commands a superb view of the Upper Engadine. In this part of Switzerland the mountains are wooded to a height of more than 7,000 feet.

Photograph by Albert Steiner

SPRING'S CARPET SPREAD AT THE FEET OF PEAKS MANTLED IN PERPETUAL SNOW

The region in the vicinity of Arosa, one of the highest winter and summer resorts in Switzerland, is noted for its Alpine flora. It is situated at the head of the Plessur Valley, in a sheltered upland basin.

Photograph by Albert Steiner

ST. MORITZ AGAINST A FROZEN BACKGROUND

This, the highest village in the Engadine, was a pilgrim resort five centuries ago; today it is far from being a religious center, for here the care-free of Europe gather to frolic the winter away.

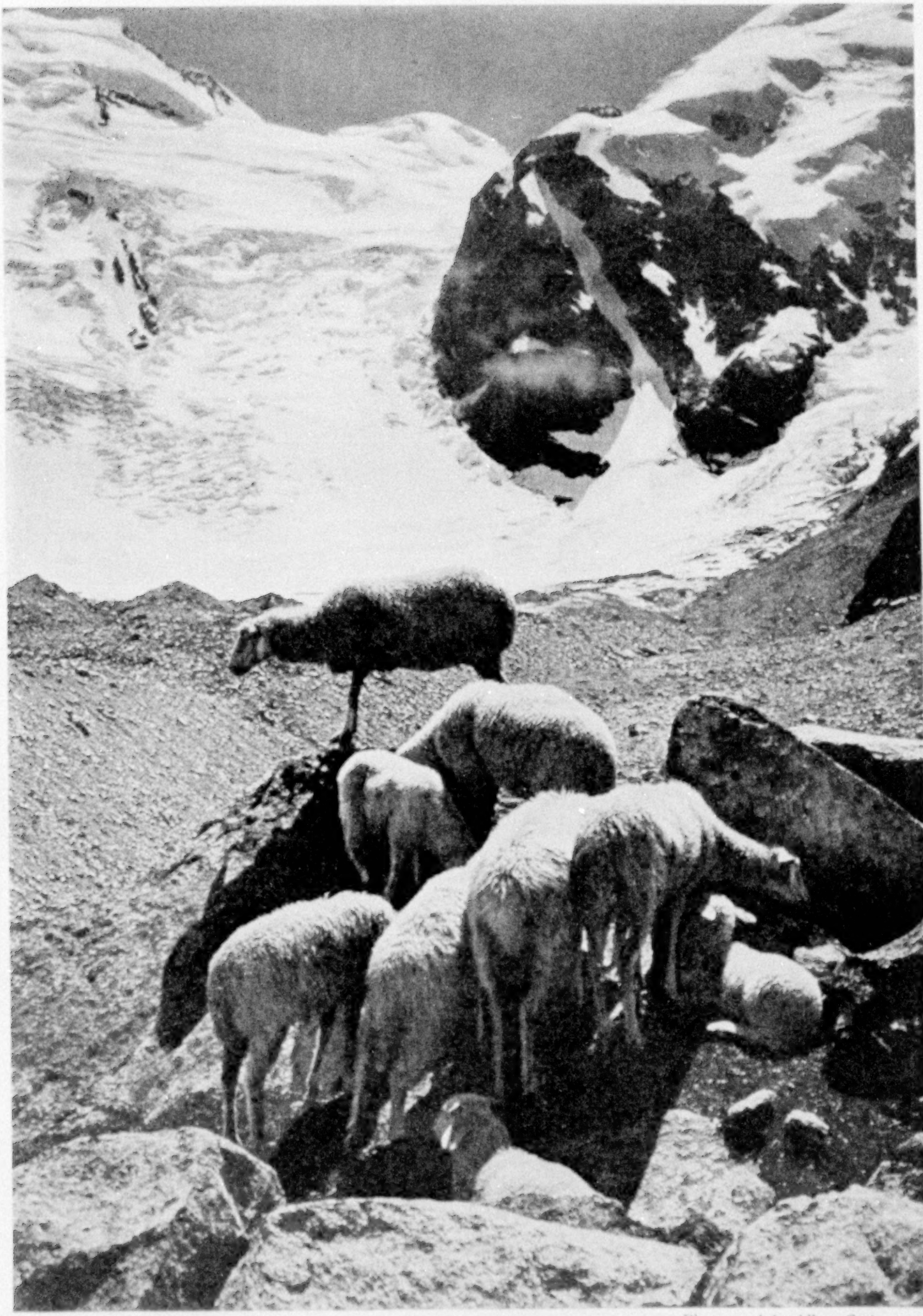
Photograph by Albert Steiner

SLED RACING ON THE LAKE OF ST. MORITZ

Skating, curling, tobogganing, ski-ing, and bandy (hockey upon skates) are among the diversions which attract thousands to this lake when ice converts it into a vast arena for winter sports.

Photograph by Albert Steiner

SNOW AND SHADOW COLLABORATE TO PRODUCE A PICTURE



Photograph by Albert Steiner

PEACEFUL PASTURAGE UNDER THE SHELTER OF THE BERNINA MOUNTAINS

Photograph by Albert Steiner

WINTER DAWN UPON THE HEIGHTS

XUM

Photograph by Albert Steiner

VESPER HOUR IN THE VALLEY

Photograph by Albert Steiner

MATCHLESS FILIGREE WROUGHT BY THE WIZARDRY OF FROST

XUM

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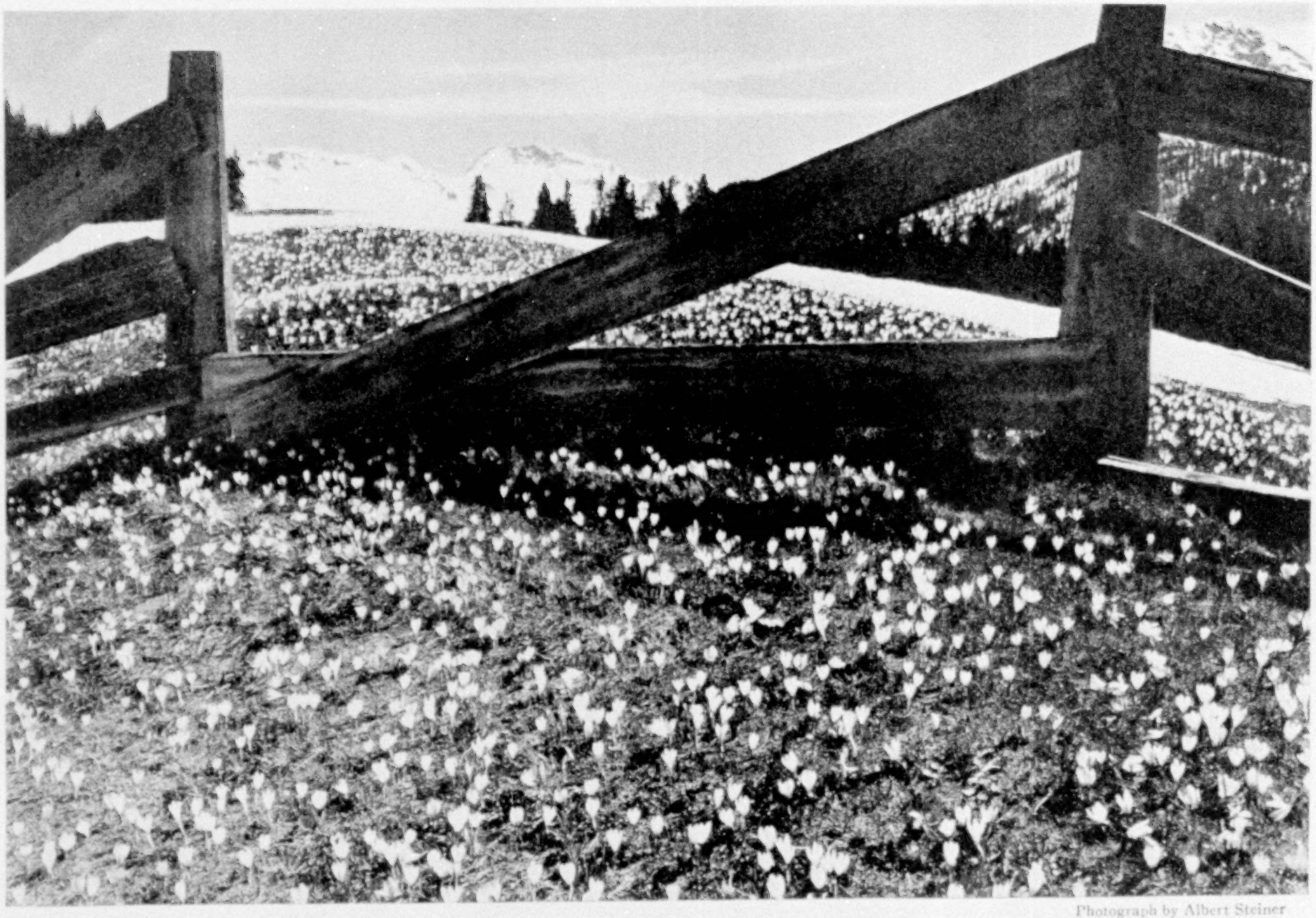


Photograph by Albert Steiner

FIRST DAYS OF SPRING IN THE CANTON OF THE GRISONS

Photograph by Albert Steiner

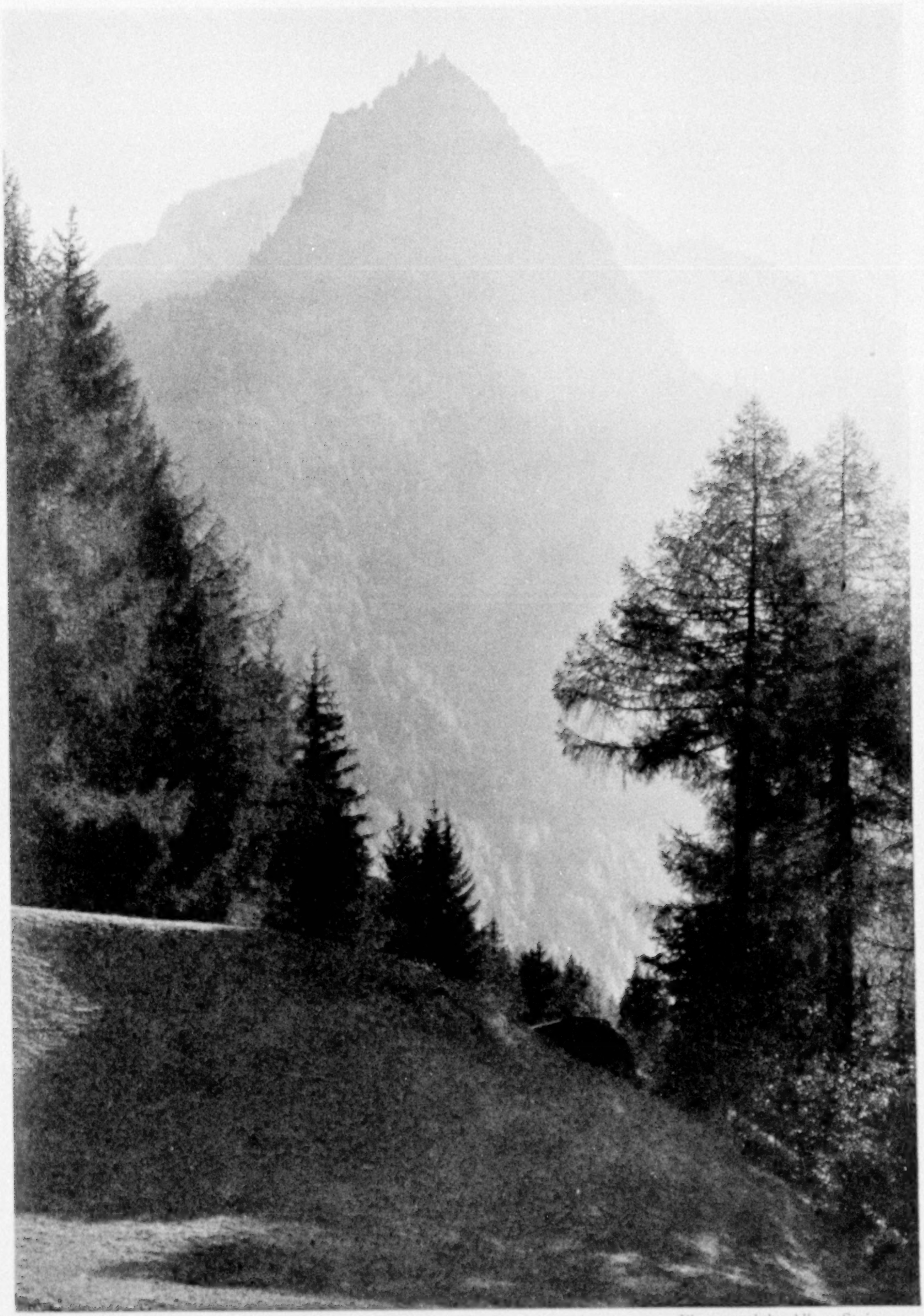
THE RHAETIAN RAILROAD CROSSES THE WILD GORGE OF THE LANDWASSER ON STONE STILTS

Photograph by Albert Steiner

SURVEYING THE PAGEANT OF THE SUNSET FROM AN ALPINE SUMMIT

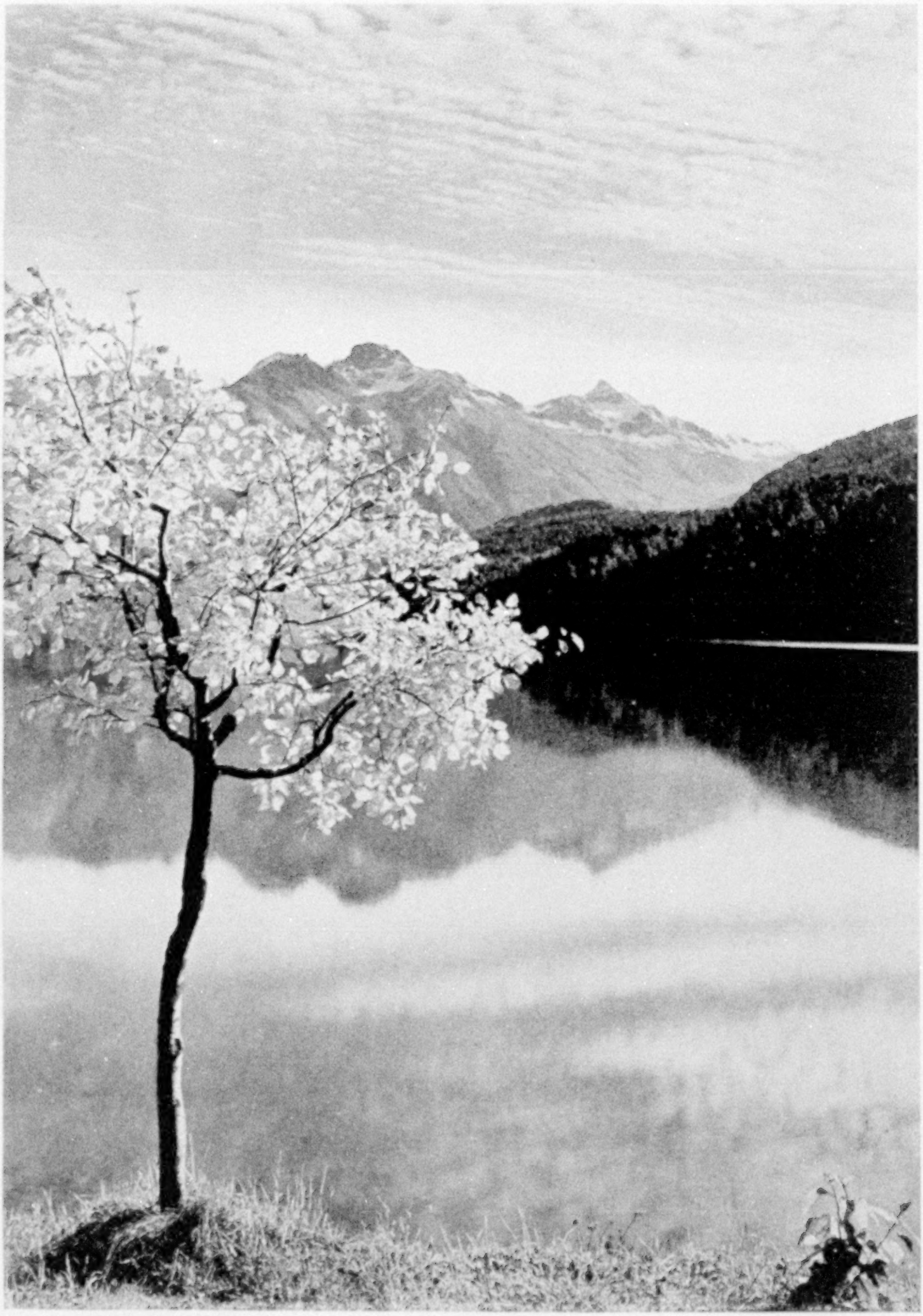
Photograph by Albert Steiner

EVENING SHADOWS IN A VALLEY OF THE LOWER ENGADINE



Photograph by Albert Steiner

THE WOODED SLOPES OF THE VAL BREGAGLIA



Photograph by Albert Steiner

THE ARRIVAL OF AUTUMN ON LAKE ST. MORITZ

AMONG THE HILL TRIBES OF BURMA—AN ETHNOLOGICAL THICKET

By Sir George Scott, K. C. I. E.

Formerly British Commissioner, Anglo-Siamese and Burma-China Boundary Commissions, and Superintendent and Political Officer, Southern Shan States

With Illustrations from Photographs by the Author

ABOUT half-way up the railway from Rangoon to Mandalay, roughly in the nineteenth parallel of north latitude, one gets the first glimpse of the range of hills which wall in the plain of Burma on the east. Toungoo, which the purists will tell you should be written Taung-ngu (that is, the Spur of the Hill), is the station on the time-table where the hill line begins to be noticeable. It is the edge of the Shan plateau (see map, page 242).

Geologists call it a plateau, but the average man would call it a Brobdingnagian nutmeg-grater or a stupendous plowed field. The spurs, which the east end of the Himalayas throw out, fade into the plain here like the edge of a beam from a search-light, and continue to do so far away to the east, across Siam, Tongking, and China.

From the train the hills do not look very formidable, but they are heavily covered with jungle, there is practically only one road from the west into the Karen country, and it is only those who are accustomed to hill roads on the borders of China who would call it a road. Others might call it a variety of things, none complimentary.

But it is this inaccessibility which has preserved through the centuries a collection of tribes such as is to be found nowhere else on the earth, at any rate in so circumscribed an area.

The Karen Hills do not measure much over sixty or seventy miles from north to south, and average, perhaps, thirty miles wide, but they have several score different clans and tribes and all these look upon their neighbors with the same suspicion and animosity as the pariah dogs of one quarter of an oriental city have for those of any other quarter.

To get to these Karen Hills it would be very unwise to make straight for them from Toungoo, or any other point on the railway. There is indeed quite a creditable path to the headquarters of the American Baptist Mission to the Karens. But unfortunately this is hardly beyond the foothills, and the really interesting tribes are beyond.

THE OPIUM TRADERS TRAVEL DEVIOUS PATHS

These Karen tribes do not grow opium. This may or may not be counted to their credit, but at any rate it is unfortunate from the point of view of communications. Farther north, where the population is Shan, with an intervening zone of hybrid races, which are like nothing so much as a dish-clout that takes up particles of everything it touches, there are what are called opium paths. These are not authorized, since the opium taken over them is all smuggled.

For this reason the paths, so far from taking comfortable lines, follow the most undesirable, and are kept as secret as possible. Therefore they are not so much like tracks as like rudimentary staircases which have been damaged by many earthquake shocks.

Progression over these paths is of the kind that Prince Henri d'Orleans wrote of when he was passing far north from China toward Assam, across the upper stretches of the Mekong and the Salwin. There he said: "We did not walk; we did not climb; it was gymnastique."

That sort of thing may be good for the liver, but it does not commend itself to students of ethnology or mere pleasure-trippers. Even such opium paths do not exist on the western slopes of the Karen Hills. The tribesmen had no wish to come down to the plains, and the Burmese, the former rulers of the country, found it much easier to come from the north.

It will not be possible to reach them by aëroplane until ascent and descent are so far improved that aircraft can land or rise from a croquet lawn or a back garden.

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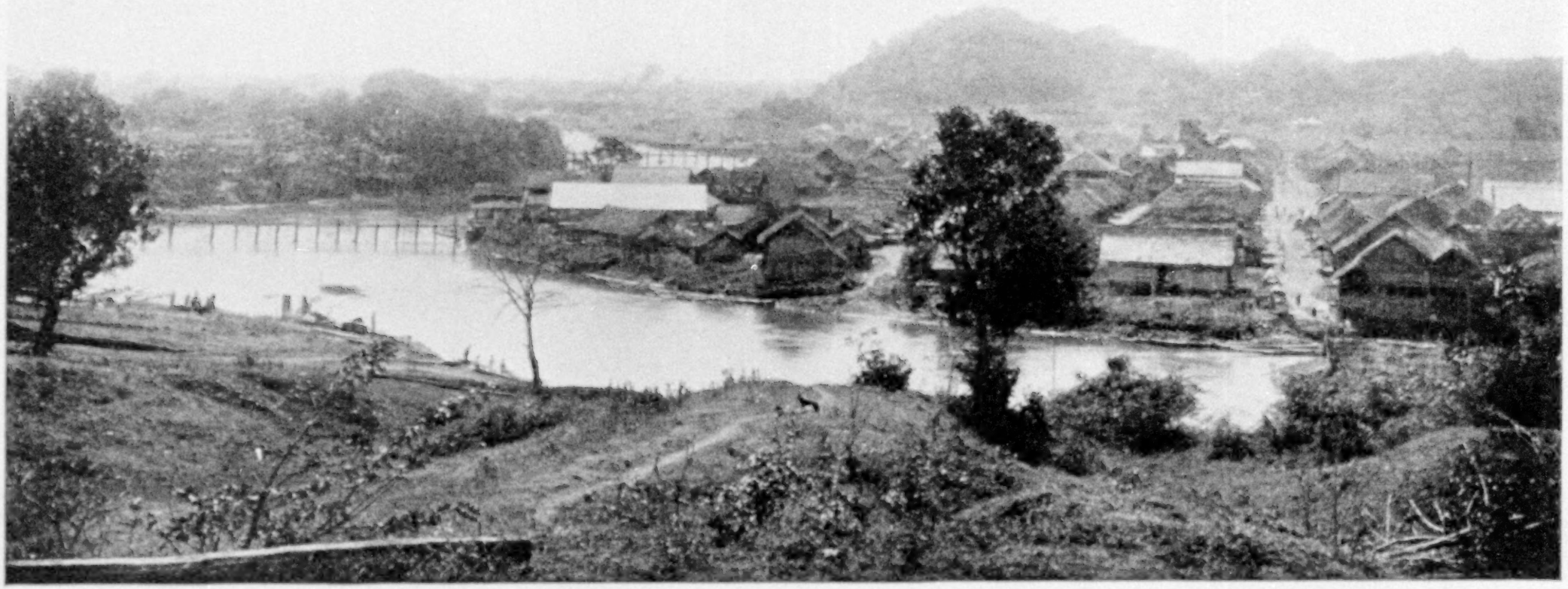
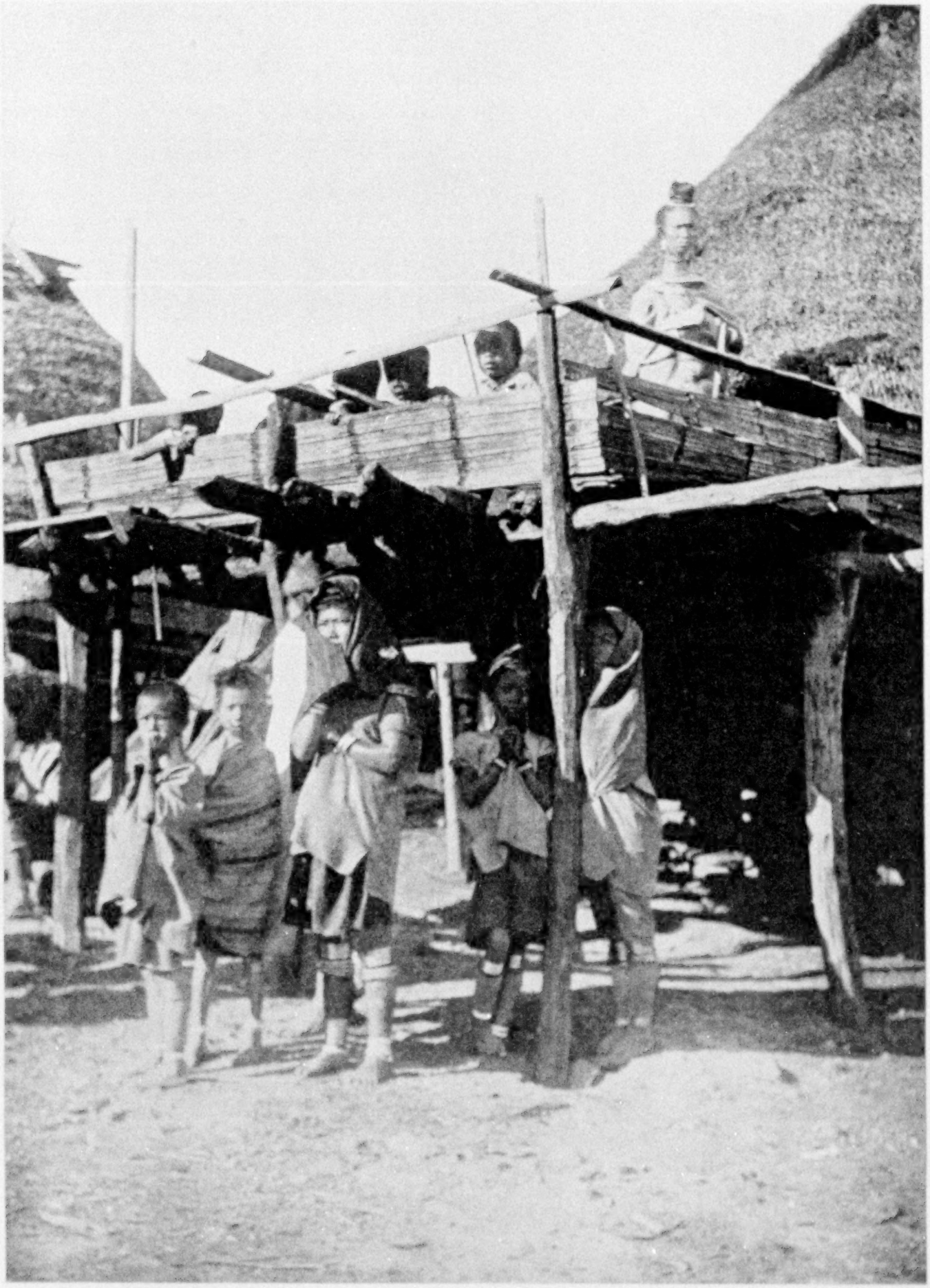


LOIKAW, THE HEADQUARTERS OF THE POLITICAL OFFICER IN CHARGE OF THE KAREN-NI STATES: BURMA

Loikaw is in the only flat part of Karen-ni. Thirty years ago it numbered four huts. The headquarters of the American Baptist Mission to Hill Karens is located here. The bridges look flimsy, but are so substantial that elephants walk over them.

THE ENTRANCE TO KIAW-KU, A BURMESE VILLAGE TEMPORARILY ABANDONED BECAUSE OF CHOLERA

The Red Karen villages are usually far up in the hills and as much off the main roads as possible. They are also surrounded by close fences of live bush growth, reinforced by dry thorn branches and stakes (see text, page 313).



KÈKAWNGDU WOMEN PHOTOGRAPHED FOR THE FIRST TIME IN THEIR LIVES

Note the onlooker, with the solemn mien of a chaperon, standing on the platform. In Burma "Her throat is like the swan" is not a mere poetic figure of speech, in so far as length is concerned (see page 315).

The way, therefore, to get to these Karen Hills is to go up by train from Thazi Junction to the edge of the plateau, and from there to march south for 100 miles. That part of the journey is easy for any one accustomed to camping out.

When it comes to climbing up to the villages, the difference is like that between a gentle stroll for the sake of the digestion, or for contemplation, and hard labor on the wheel, or between croquet and coal-mining.

Animals can go, but it is not well to trust to them. It is on record that a baggage elephant took fourteen hours to cover four and a half miles, and would probably have taken much longer if practically all its load had not been brought in by coolies, and these coolies were the hillmen themselves, not outside men.

RED KAREN WOMEN RESEMBLE WITCHES IN "MACBETH"

Still the visit is worth the trouble and it is an excellent way of reducing weight. The Karens of the hills are savages, no doubt, but not of the kind that eat one another or cut off heads.

There is no need for the visitor to take a Tartarin de Tarascon battery with him. No great amount of money is necessary, either. Beads and small mirrors and clear glass bottles are much more useful, though latterly not a few villages have become sophisticated enough to like rupees, too. But that is because the girls make necklaces of them.

There are a great many Karens in the main province of Burma, and they were, and still are, commonly referred to by their Burmese neighbors and strangers within their gates as White Karens. These Karens do not admit the hill peoples, for convenience sake called the Red Karens, to be their relations, and have the same feelings with regard to them that the Abelites have for the Cainites. It is perhaps natural. Nobody cares for poor and ill-conducted relatives.

The White Karen women are scrupulously clean and neatly, if hardly smartly, dressed. It is a matter of opinion whether they are comely, but at any rate they are sleek and built on substantial lines, and their faces are of the kind that appeals to the Zulu or the story-tellers of The Arabian Nights, who preferred the moon-face to one of the Greek classical type.

The Hill Karens, genuine Red or otherwise, are obtrusively dirty, so dirty that they cannot get any worse, because no more matter can find a place to settle.

Some of these Red Karens wear clothes that force one to believe they are heirlooms, and here and there not a few of the clanswomen might pose day or night, outdoor or in, at a moment's notice, as the witches in "Macbeth." It is a pity, for quite a number of them look as if, after being boiled and scrubbed, they might be well-favored, or at any rate personable.

The Karens are the third most numerous population in Burma. Naturally the Burmese are the preponderating race; next come the Shans, and after them the Karens, with a total which the census of 1921 will almost certainly show to be well over a million.

The different clans are as mutually unintelligible to one another as a Cantonese is to a man of Fuchow or a Pekingese. But that does not prevent Sir George Grierson, the great authority on the ethnology of the Indian Empire, from deciding that Karen is a group of dialects, not of languages, and that it includes only the one language, Karen, spoken in greatly varying patois.

ORIGIN OF THE KARENS IS A MYSTERY

We do not know the original home of the Burmese, or of the Tai, usually called Shans, but what we do know of them, though it is neither extensive nor exact, is full compared with our information as to the source of the Karens. The most baffling thing is that they have no national comprehensive name for themselves, not even for the most numerous and enlightened branch, the White Karens, and what legends they have only lead the learned to disagree, more or less acrimoniously, with one another.

It is perhaps unnecessary to say to any one who knows anything about Indo-China that the name Karen, which we give them, is not known to the people themselves as a nation at all. It is a name borrowed from the Burmese, and how they evolved it nobody knows. At any rate the Karens are miscalled, just

PADAUNG COLD-WEATHER COSTUME

The Padaung women, or Kèkawngdu, as they call themselves, are remarkable because of the extraordinary collars they wear, and are taken down to Mandalay to be gazed at by the Great King of Righteousness and the dwellers of the palace. They have also been on show at all viceregal and less notable durbars (see text, page 315).

WHITE KAREN GIRLS AND CHILDREN (SEE TEXT, PAGE 297)

The White Karen women are much cleaner than their hill sisters, but unfortunately do not look nearly so alert. They reside in the main province of Burma and do not admit that the Red Karens are a related people. Note the primitive notched-log staircase.

300

A KAREN PLACE OF SACRIFICE (SEE TEXT, PAGE 313)

The rickety bamboo platform is the altar, with half a pig as an offering on it. The curved wooden slab in front is for offerings of flowers and fruit. When any member of a Red Karen family falls sick, a sacrifice is made to appease the wrath of a presumably aggrieved spirit. A fowl is killed and the bones are examined to find out the pleasure of the nat (the Burmese word for spirit). When this is settled the required animal is slaughtered and the head, ears, legs, and entrails are deposited in the nat-sin (shrine of the spirit).

as the Tai are termed Shans, the Chingpaw are dubbed Kachins, the Mon are labeled Talaings, and the Sho, Chins.

Tribal names the Karens have. There are three main tribes of them, the Sgaw, the Pwo, and the Bghai, or Bwè. The Pwo are by far the most numerous, and if to them are added the Pao, who are usually called Taungthu (*i. e.*, hillmen), they include half the race. But the Pao obstinately refuse to be called Karens.

The Karens did not come into Burma in waves, or hordes, like the Burmese and the Shans. No doubt they were displaced by invading neighbors, or migrated because of overpopulation, but they came in in driblets rather than in masses.

THE KAREN TRADITION OF THE CREATION

The people may be taken to be pre-Chinese, and not Tibetan or aboriginal in their present seats, or descendants of the lost Ten Tribes, as some enthusiastic proselytizers would have us believe.

This last conception is due to their traditions of the creation and fall of man, thus translated in strange form by Dr. Mason in his "Burma":

"Anciently God commanded, but Satan appeared, bringing destruction.

"Formerly God commanded, but Satan appeared, deceiving unto death.

"The woman E-u and the man Tha-nai (Adam and Eve) pleased not the eye of the dragon.

"The woman E-u and the man Tha-nai pleased not the mind of the dragon.

"The dragon looked on them — the dragon beguiled the woman and Tha-nai.

"How is this said to have happened?

"The great dragon succeeded in deceiving, deceiving unto death.

"How do they say it was done?

"A yellow fruit took the great dragon and gave to the children of God.

"A white fruit took the great dragon and gave to the daughter and son of God.

"They transgressed the commands of God, and God turned his face from them.

"They transgressed the commands of God, and God turned away from them.

"They kept not all the words of God—were deceived, deceived unto sickness.

"They kept not all the law of God—were deceived, deceived unto death."

This is the White Karen version. The Red Karen deals with creation. Their name for God is Ya-pe:

"The earth at its origin Ya-pe created.

"The heavens at their origin Ya-pe created.

"Man at his origin Ya-pe created.

"The sun at its origin Ya-pe created.

"The moon at its origin Ya-pe created.

"The trees at their origin Ya-pe created.

"The bamboos at their origin Ya-pe created.

"The grass at its origin Ya-pe created.

"The cattle at their origin Ya-pe created."

It seems probable that these religious traditions may have been derived from the Nestorians, who were prominent in China during the Yuen dynasty, and have left a mark behind them in the monument at Sianfu, in Shensi. There are also to the present day Jewish villages in various parts of China that possessed the Pentateuch, and these may have been the source of the Karen legend

At the same time it may be pointed out that savage fancy not unseldom suggests ideas curiously like biblical statements.

A BURMESE TRADITION TELLS HOW GODS BECAME MEN

The Burmese have a myth that heavenly beings came down from the skies to the earth, and there ate Thalésan, a particular kind of rich rice, which gradually made them gross of habit, so that they were unable to make their way back to the higher heavens again, and had to become men and women. This suggests the "fruit of that forbidden tree."

The Chins have a story of the Tower of Babel to account for the various clans that inhabit the range of hills looking down on the Bay of Bengal, and traditions of a deluge are found everywhere.

The Kachins tell a story of the passage over a bridge, to the after-life, which recalls Addison's "Vision of Mirza," and there are many more of the kind that suggest that these folk-myths come down from a long-gone past, like the far-carried boulders of the Glacial Age.

The Sgaw and Pwo of the plains are as civilized as any of their neighbors. The Bghai of the hills are as isolated as the boulders and as little changed from their original state. They are quite a

A PADAUNG DANCE

The movements, to the accompaniment of tuned cymbals and deep-toned gongs, are confined to swaying and side-stepping to funeral measure. There are very few instances of "mixed" round dances in Indo-China and it is singular that it should be found among the Red Karens. Holding hands is considered improper by the Burmese.

KAREN LADIES POSED FOR THEIR PICTURES BY AN OFFICIOUS HEADMAN

The lady on the right is determined that the evil eye shall not fall on her infant. The taking of photographs was by no means an easy matter in the earliest days of the British occupation. It was looked upon as white magic (see text, page 313). One day a chief upon being invited to look at the focusing glass exclaimed, "Why, they're all upside down!" The women took on a conscious attitude on the spot, and the men shifted their feet uneasily, all of them adopting a stained-glass attitude.

THESE SIN-SIN KAREN LADIES TAKE A SOMBER VIEW OF LIFE

The hair of each is drawn through a bamboo ring and confined by a species of thimble at the top. The Sin-sin group do not insist on marriage within the clan, and the women have largely intermarried with the Taungthu, wear cotton coils round the waist, dispense with a petticoat, and instead of a brass rod wear a silver bracelet. Men, women, and children of this group are inveterate smokers, their pipes being made of dry bamboo.

good bit ahead of the cave-man. They are not cannibals or head-hunters and do not seem ever to have had tastes that way. They are not all of them quite on this modest level.

The Red Karens and Padaungs are a long way ahead of the others, and were so far civilized that in the days before the British occupation of the country the former were highly organized slave-traders, making raids into the Shan States to the north to carry off men, women, and children, whom they sold over the eastern border in Siam.

They were shrewd enough to know that ecclesiastics were the most profitable booty; for, since both the Shans and the Siamese are Buddhists, good money was always rapidly forthcoming to ransom the pôngyis, or monks. Sometimes they were ransomed by the people of the villages to which their monasteries be-

TAUNGYO GIRLS FROM THE OPEN COUNTRY: BURMA

The gaiters worn by the girl on the right are to protect her against leeches. The earrings and bracelets are of silver.

THE ZAYEIN KAREN WOMEN WOULD BE COMELY IF THEY WERE LESS UNKEMPT

The men of this clan shave their heads, except for a small patch over the ears, but the hair of the women is generally neglected. Washing the body is deemed an affectation. The inevitable coils of brass rod cover the forearms.

longed, which was the easiest way of getting rid of them, or if all the villagers themselves had been carried off, the pious of the Lao States of Siam were always ready to put up the money and thereby acquire merit toward a new existence.

TRIBES DIVIDED ACCORDING TO CLOTHES

The White Karens of the plains of Burma were easily converted to Christianity, and their pastors and masters set to work to index them with more zeal than discretion.

The so-called clans read like a table of fashion-plates or a history of tartans. The only visible distinction between one clan and another was the dress worn, and naturally, when it came to dress, it was the women that were tabulated.

In one place the women wore a smock with red perpendicular lines. In another there were no lines on the white blouse; instead, there was a narrow border of embroidery at the bottom, with subvariants. Some men had red trousers, others white, with radiating white lines, and so forth.

This haberdashery sort of business is catching, but it is not scientific.

It is not confined to the Karens. The names of the Kachin tribes in the hills to the north of Burma are bewildering beyond endurance, and the Chin clans are not much better. In fairness to the white cataloguers, it is only right to say that the people themselves are mostly responsible, and they had, apart from this, predecessors in the Burmese who recorded such blocks as "River Sheep or Burmese Karens," "River Kyieng or Talaing Karens," "Forest Bees," "Ogres," "Large" and "Small Butterfly Karens," and "Wild Karens." These may be more picturesque, but they are not less scientific than the existing tables.

In the hills there is more justification for this sort of thing than in the plains, for in a formidable tumbled-up mass of peaks and deep gorges there are scores of people who have never been more than ten or twenty miles from home, and so have had years'-long opportunity of developing special village patois. The Karens have, perhaps, suffered more than

A GROUP OF PADAUNGS COME TO MARKET ARRAYED IN ALL THEIR FINERY

Formerly the natives feared the occidental camera, but now the difficulty is to keep people out of a picture. When a traveler wants fowls or vegetables, it is suggested that a photograph would be the most satisfactory mode of payment, and the result is that the villagers crowd in behind to furnish a background. (For a description of the costumes, see pages 315 and 317.)

most in this way and their aliases suggest nothing so much as *Chevaliers d' industrie*, or a slang dictionary.

It is very much as if an inhabitant of Mars were to land in the U. S. A. and gravely record Yankees, Hoosiers, Blues, Pukes, Pennamites, Creoles, Crackers, and Beef-heads as tribal names distinct from Americans proper.

STRIKING PHYSICAL DIFFERENCES BETWEEN RED AND WHITE KARENS

If one were to judge by build and facial characteristics, there is no family connection between the White and the Red Karen. The White Karen is heavy, stolid, and much more stocky in build even than the average Burman. He is what might be called a "worthy" person in the most offensive sense of the word. He is bovine, suspicious, and without any sense of humor. Except in very hot weather, he does not wash himself as often as he ought, and he would certainly defeat prohibition by brewing his own liquor.

The Red Karen is of an entirely different physical type. The men are small and wizened, but very wiry. They have broad, reddish-brown faces and long heads, with the obliquity of eye a little more accentuated than the White Karen, and very much more than the Burman. In former days it was the invariable custom that the men should have the rising sun tattooed in bright vermilion on the small of the back. This custom has fallen into disuse; and the younger men are without it, but they are so desperately dirty, old and young, that a personal detail of this kind is hardly noticeable without close inspection.

LEGS OF WOMEN OF FASHION ARE HEAVILY ARMORED

They wear short trunks reaching to just below the knee. These are red when new, but they speedily turn to an earthy color. These "shorts" are kept in position by a leathern belt, and in the hot weather constitute the entire dress, except for a cloth wound around the head,

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TWO KÈKAWNGDU WOMEN MAKING PURCHASES IN THE KAWNG-I BAZAAR: BURMA

The stall-keepers are Shans. The ring at the back of the neck is more clearly seen on the woman sitting down (see text, page 315). The "well-dressed" Karen woman wears as much as 50 or 60 pounds of brass rings on neck, arms, and legs.

above which the hair appears, tied in a knot.

The women wear a short skirt which comes as far as the knee. Usually it is dark-colored, but occasionally it is red. A broad piece of black cloth passes over the back across the right shoulder, and is then draped over the bosom, and confined at the waist by a white girdle, knotted in front, sash-fashion, with flowing ends hanging down with more or less grace, according to the length of time it has been worn.

Round the waist and neck are ropes of barbaric beads, to which the wealthy occasionally add long necklaces of rupees. A profusion of the beads also decorates the leg just above the calf, which is circled by a solid mass of garters of black cord or rattan. Perhaps they should not be called garters, seeing they do not serve to hold up anything. Anyhow, these leg-rings, together with the beads, stand out a matter of two inches from each sturdy limb (see pages 298 and 302).

The result is that their wearers walk

A KÈKAWNGDU DRUM DANCE: BURMA

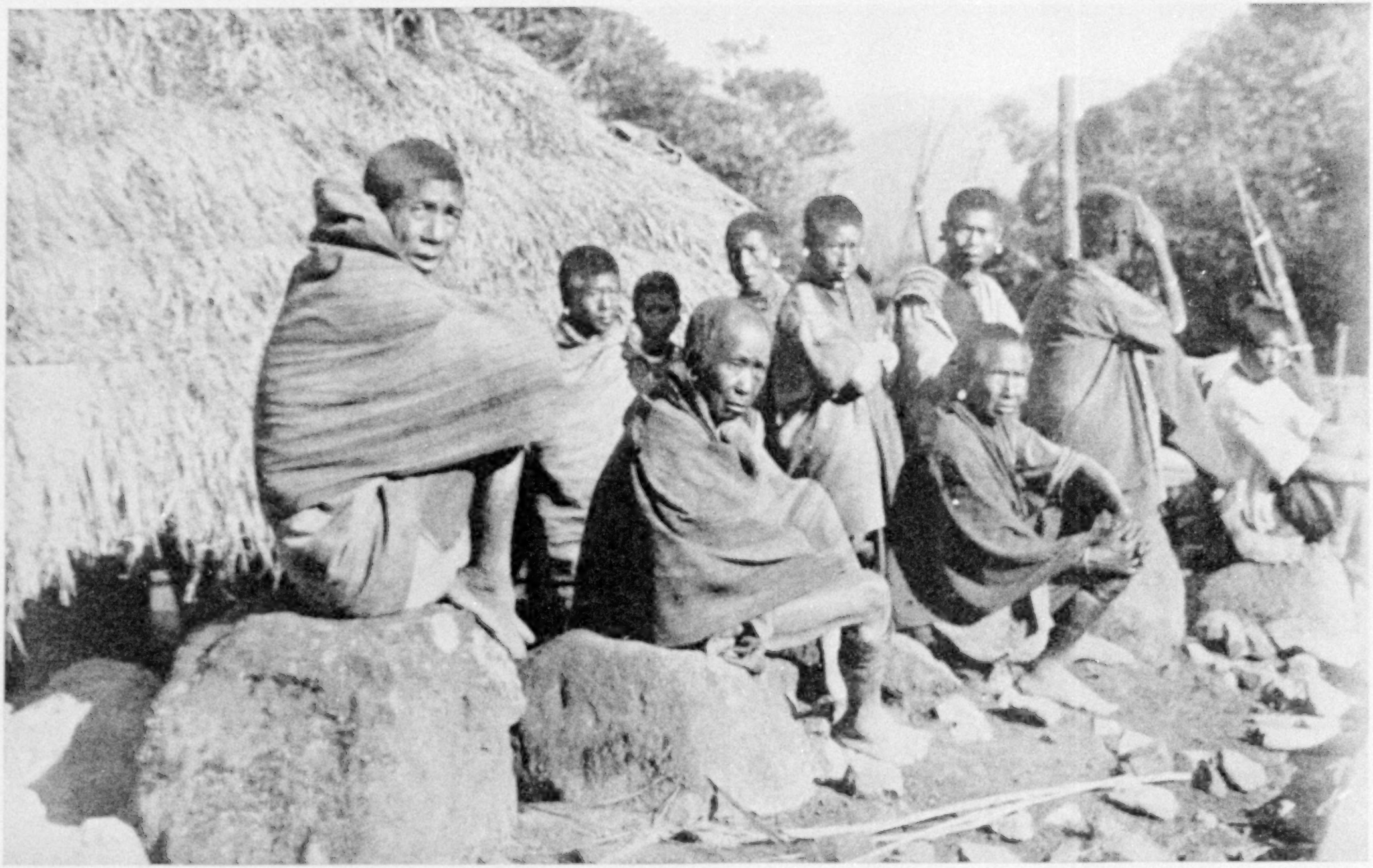
The man in front of the tom-tom strikes it to a measure. The man on the left of him ducks through between beats. Success means a beaker of spirit at the cost of the striker. Failure, in addition to the clout, means that he has to stand the drink. The Kèkawngdu occupy a tract of 150 square miles and are excellent agriculturists (see text, page 317).

with a sort of compass-like action, and could not run, no matter what the urgency might be. Moreover, it is not easy for them to sit down, and when they do at market stalls or to spin, they stretch their legs straight in front of them. This, to the Shan and Burmese mind, is highly indecorous, for with them the first law in society manners is to hide the feet.

Silver earrings, some of them so large as to be better called ear-cylinders, are worn, and over the head is jauntily thrown a piece of black cloth with red tassels, like those of the Taungthu. The general effect is picturesque and would be really attractive, were it not for a not uncommon meaty odor.

UNCONQUERED BY BURMESE, KARENS QUICKLY YIELD TO BRITISH

The Burmans were never able to overcome the Red Karens, though they made several definite attempts. When the value of the Karen-ni teak timber became



IN FRONT OF A KAREN BACHELORS' HALL (SEE TEXT, PAGE 319)

The unmarried "youth" wear a special dress, varying with the clans. Some have coquettish shell jackets trimmed with seeds or cowries. Almost all have necklets of colored beads, seeds, or stone and wear ear-plugs of every sort of material, from plain wood to chased silver.

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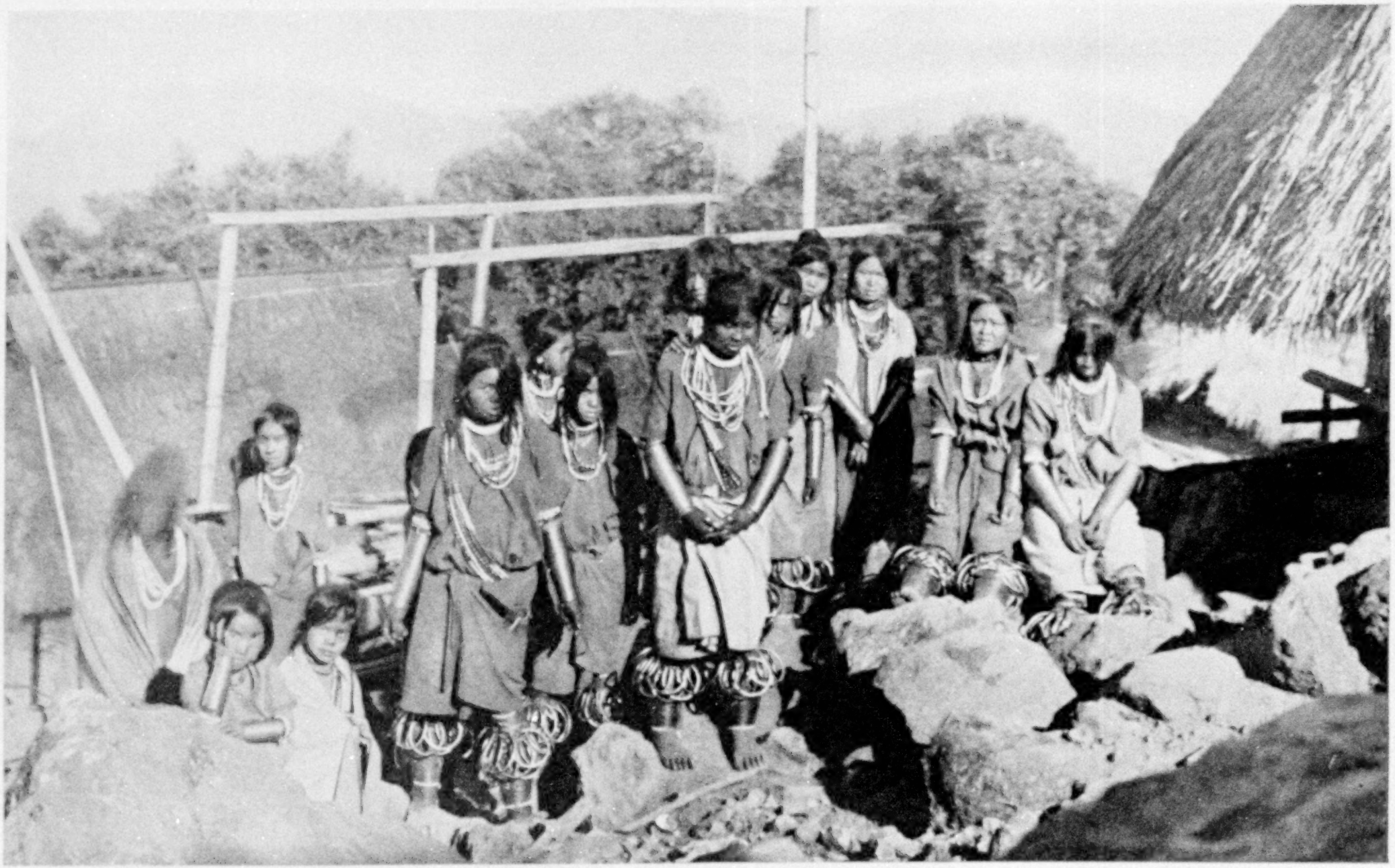
GAUNGTO (ZAYEIN) BOYS BUYING CANDY IN THE KAWNG-I BAZAAR

The big hat of the Shan stall-keeper is made of bamboo spathes. One of the strange superstitions of the Gaungto is that which forbids the presence of eggs in a village during the reaping of the fields. As soon as the harvest begins, all the eggs in the community are gathered and thrown away, outside the village.



DAMES AND DEBUTANTES OF THE KAREN HILLS

The background gives an idea of the topography of the region inhabited by the Red Karens—a jumble of steep hills with narrow valleys between. The paths are almost impassable for beasts of burden (see text, pages 203 and 207).

known, the Indian Government interfered, and by the treaty of Sir Douglas Forsyth the independence of Karen-ni was guaranteed. When, therefore, in 1886, the Burmese Kingdom ceased to exist, it appeared that this independence was guaranteed by the Government of India against the Government of India, and the five Karen-ni States remain under ruling chiefs, but they are under the control of the political officer of the Southern Shan States and are only technically outside British India.

For a time after the occupation of the Shan States the Red Karens gave some trouble, and ignored letters of warning. They believed that British troops could no more take Sawlôn than the Burmese could, and accordingly they went on stealing cattle, and even overran a neighboring Shan State (Mawkmai), burnt the capital, and carried off slaves, quite as in the old days. Accordingly a British column marched against them, and the resistance collapsed with dramatic rapidity. Since then the Karens have given no trouble. From swaggering bullies they changed, in a matter of weeks, to listless cultivators.

In the old days the Red Karen never went out without *dha* (sword) and gun, and in addition had a small sheaf of spears or rather javelins. Now, the guns remain at home, only to be used when there is a death in the village. They are fired then to scare away the disembodied spirit.

All the dead are looked upon as evil-minded or, at all events, malevolent characters, best driven away.

THE DISTINCTIVE KAREN SPEARS HAVE VANISHED

The Karen spears have vanished so completely that the hunter after curios has difficulty in getting them. They were of a very distinctive character, sharpened on one side only, like a knife-blade, with a male bamboo shaft that had a spike at the butt, so that the owner could stick it in the ground when he was hoeing his fields or cutting his crops, and be ready for any stranger.

But the Red Karen remains a heavy drinker. Early prospectors for teak forests used to say that a genuine Karen-ni never went abroad without taking a bamboo on his back, from which a tube led to his mouth. Apparently they could carry their liquor then, inside and out.

In addition to their liking for spirits from the still, the Red Karens are devotees of the spirits of the air, the flood and the fell. Latterly a few have become nominal Buddhists, and some have even founded monasteries and built pagodas, but none of them give up their belief in nats, to use the Burmese word for spirits.

The most obvious occasion for worship is when any of the family fall sick. A sacrifice is then made to appease the wrath of the presumably aggrieved spirit. The first thing killed is a fowl which is cheap, and the bones are then examined to find out whether the nat would like fowls, pigs, dogs, or bullocks as a sacrifice. When this is settled the required animal is slaughtered, and the head, ears, legs, and entrails are deposited in the *Nat-sin*, the shrine of the spirit (see page 300). The family eat the more desirable parts of the carcass which remain.

In the old days sacrifices of this kind on a larger scale, since the whole village was concerned, were always the prelude to a raid, or a warlike expedition against thieving neighbors.

CHICKEN BONES ARE A "WHERE-IS-IT?" BOOK

Chickens' bones are the Red Karen's dictionary and "Where-Is-It?" book. He consults them to know where he should build his village or his house; whether he should start on a journey, and, if so, in what direction, on what day, and at what hour; whether he should marry a certain girl, and, if the omens approve, on what day he should do it; where he should make his hill-clearing, when he should prepare, sow, and reap it; in fact, he does nothing without authority from fowls' bones.

The Red Karen villages are usually far up in the hills and as much off main roads (if paths a couple of feet wide, along the sides of hills or meandering up rocky gorges can be called roads) as possible. They are also surrounded by close fences of live bush growth, reinforced by dry thorn branches and stakes (see page 295).

The Karen-ni are firm believers in original sin, and, to baffle thieves, keep

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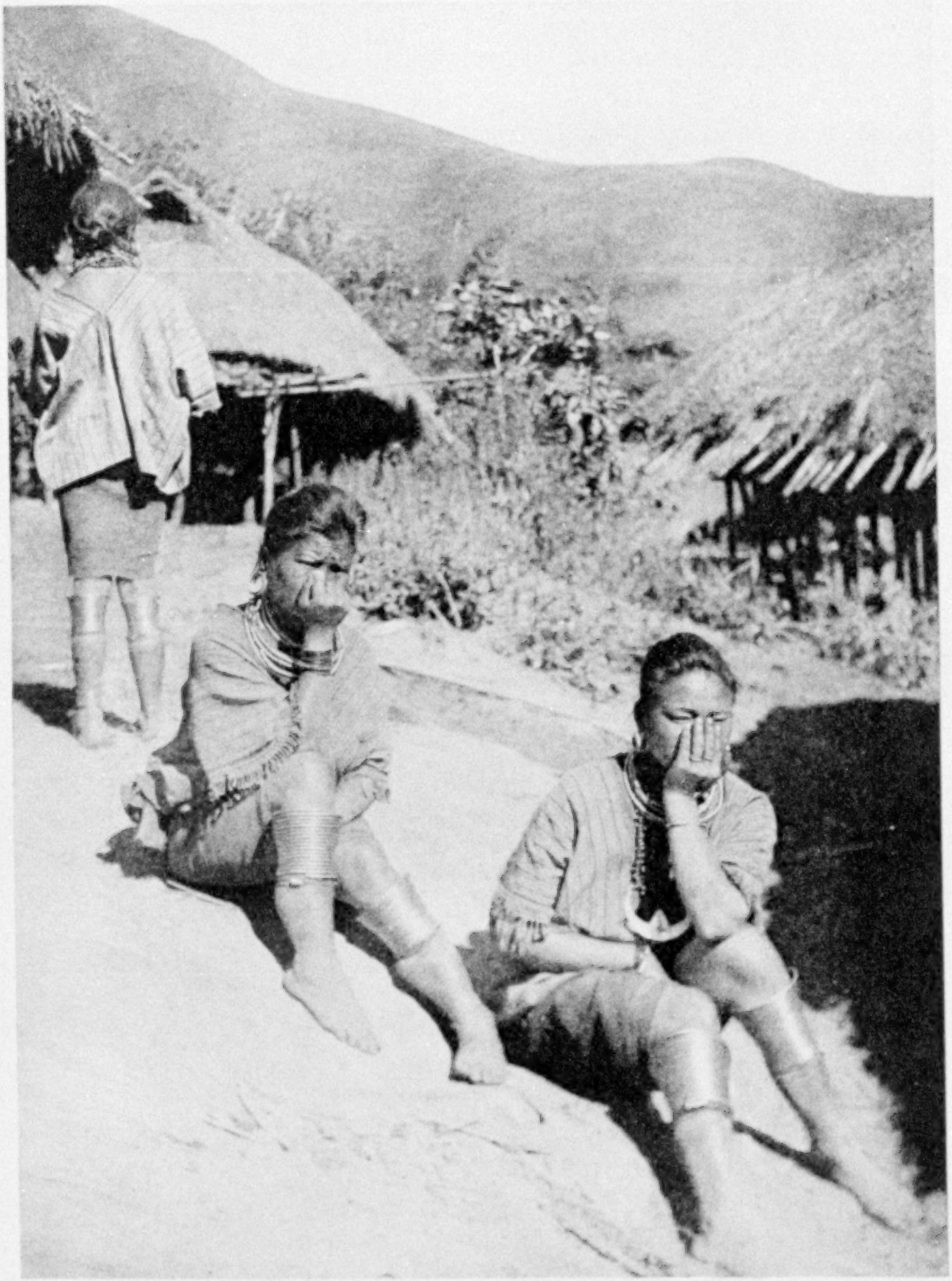


BRÊ GIRLS, VERY DISTRUSTFUL OF THE PHOTOGRAPHER

Note the boar's tusk necklace. The household means have not admitted of brass coils around the arms, but the legs have not been neglected; neither have the lobes of the ears (see text, page 318).

their pigs, oxen, and buffaloes below their houses, which stand on piles. They have quantities of timber, so their houses are much more generally of wood than those of the Shans, farther north. Like them, they are covered with thatch, and the eaves come down to the floor level; consequently they are almost pitch-dark (see pages 310 and 314).

BURNING ALONE SPRING-CLEANS A KAREN-NI HOUSE

The fact that the houses are solid and last a long time is rather a disadvantage. One visit to a Karen-ni house usually satisfies the most curious. He makes for his tent afterward and scratches himself spaciously. If you travel in these hills, take a tent with you and pitch it outside the village. Burning is the only satisfactory way of spring-cleaning a Karen-ni house.

The people have feasts, which consist mainly in gorging on fowls and pigs, and much drinking of spirits. They have dances; the most energetic is a sort of die-away Maypole figure.

The latter-day Red Karen is a very listless person. Those who are not steal elephants and other people's property generally, and have to be suppressed.

This apathy may be said to be born with them. When a Karen-ni child is born the mother takes the baby in her arms, as soon as she is able to walk down the sloping board with nicks in it which constitutes the staircase (see page 299), and gets a mattock from under the house. With this she hoes up a little ground. This is to impress upon the infant that it will have to work for its living.

The children do not get a good start. They are fed with liquor from their earliest years. If a mother is too zealous at hoeing the fields to find time to suckle her infant, she takes a mouthful of liquor and feeds it from her own lips.

The taking of photographs was by no means an easy matter in the earliest days of the British occupation. It was looked on as white magic, and the sight of the camera, and more particularly of the focussing cloth, was enough to send all the women scuttling off into the jungle or into the black darkness of their homes.

Perhaps no one is altogether free from self-consciousness when being formally photographed, but of these tribes the Padaungs are the least affected and the least unwilling to have their likenesses taken. They are remarkable because of the extraordinary collar worn by the women. Even in Burmese days, Padaung women, or Kèkawngdu, as they call themselves, were taken down to Mandalay to be gazed at by the Great King of Righteousness and the dwellers in the palace. They have also been on show at all vice-regal and less notable durbars, and are quite as much accustomed to being snap-shotted as actresses or political leaders (see illustration, page 298).

The women's neckband is of brass rod, as thick as the little finger, commencing with a wide base on the shoulder-blades and reaching up to the chin. Little girls begin with them as early as possible, and five rings are as much as most of them can manage, but the neck is kept constantly on the stretch, until the ordinary limit of twenty-one coils is reached. Twenty-five seems to be the record.

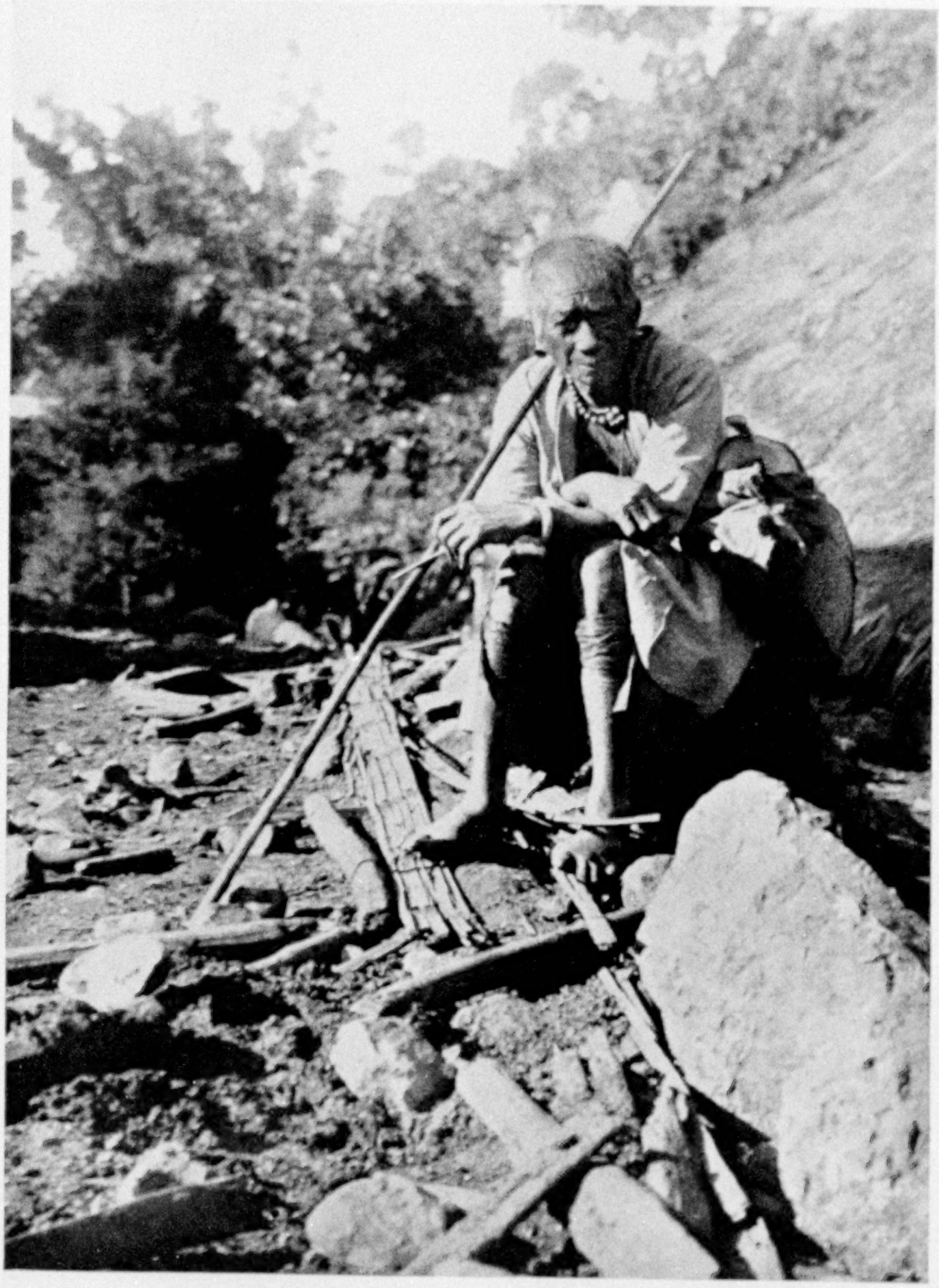
At the back of the neck, fastened through the main coil, is a circlet of rings, about double the diameter of those used for curtains. The inevitable suggestion is that these are used for tying the ladies up when occasion seems to require it. Inquiry of the Kèkawngdu has not so far resulted in a direct answer. They all grin. In the case of the men, this may mean the acceptance of a hint, or a tribute to the questioner's acuteness.

THE AVERAGE WOMAN WEARS 50 OR 60 POUNDS OF BRASS RODS

In the case of the women, a glance at the arm appears to imply that they have on both arms a weight of brass, which would give a clout that would defy coercion, for they have similar coils of brass rod on the legs and the arms, and the length of these seems only limited by the space available or the ability of the household to pay for the rod, for brass is very expensive (see illustration, p. 308).

The total weight carried by the average woman is fifty or sixty pounds, and here and there some manage as much as seventy or even eighty.

Burdened with this weight, they hoe the fields, carry water for domestic use,



A GAUNGTO BACHELOR

"I have no wife to bother my life." The rules governing marriage within the clan are so strict among many of the Karen groups that in some places there are many doddering bachelors in the Bachelors' Hall and plenty of aged spinsters without a home of their own (see text, page 319).

and go long distances to village markets to sell liquor. They brew a great deal of very fiery stuff and sell it to most of their neighbors, carrying it in flagons made of woven strips of bamboo lacquered over with wood-oil, and dispensed in goblets of the same manufacture.

The cups are of most generous size. They hold about half a pint, and those not trained to it usually become noisy after one.

The brass-collar fashion does not seem to affect the women's health. There are plenty of active old crones among them and families of eight or ten are quite common. The only noticeable effect is that the women speak as if some one had them tight round the neck. They wear colored scarfs twisted into the hair, jumper coats which slip over the head, have a fashionable V-shaped front and back, and very short sleeves, with occasionally a little embroidery.

The skirts are really kilts, stopping above the knee and striped red and blue. The necklaces are of the usual kind, with cornelians and other stones, coins, and beads.

The men are not nearly so picturesque. Near main trade routes they wear the baggy trousers and short coats of the Shans. The remoter villagers wear shorts and cane leg-rings. An attempt at decoration is seen in the anklets made of shirt-buttons and kaleik seeds (the white seeds of a herbaceous plant), and every man carries a powder-and-shot case strapped to his belt. These are of wickerwork, neatly embroidered with brass bosses and raised scrollwork, and they glitter with wood-oil varnish.

GREAT SKILL SHOWN IN BUILDING IRRIGATED TERRACES

The Kèkawngdu occupy a tract covering, perhaps, 150 square miles. They are zealous agriculturists. Every available nook of the valleys is terraced for irrigation, which is carried out with great skill and eye for contour. They grow a good deal of cotton and make their clothes of it. The average height of their country is between three and four thousand feet, with peaks rising to five thousand. Their roads are well aligned, fairly broad, and much used, and are considered very good by those who have been traveling over other hill-roads, though a bicycle would have to be carried for three miles in every four.

Pack bullocks are kept and caravans go down to Toungoo on the railway. On the whole, they may be said to be the best of the hill races in this neighborhood, and they have great game drives with trained dogs (see pages 296, 298, 302, and 307-9).

Some authorities have doubts as to whether they are Karens and want to place them in the Môn-hkmêr group. Their language, however, has many similarities with Taungthu.

MALIGNANT SPIRITS ARE SEDULOUSLY WORSHIPED

Like all their neighbors, they are spirit-worshipers, and the names of their divinities seem to be much the same for all. Some of the spirits are bad, some indifferent, and a few amiable. The malignant ones are sedulously worshiped with sacrifices, the others only at moments of leisure or expansiveness, after surplus liquor has been consumed.

Some distance to the north of the Padaung country—with the small Red Karen State of Nawngpalai intervening—is the Brè tract.

Their country is of a different character from that of the Padaungs. It is a much more emphatic jumble of hills, very high and steep, with exceedingly narrow valleys in between.

The dress of the Brè men is more distinctive than that of the Padaungs. They wear a pair of very short trousers, striped red and white, and tied at the waist with a bit of string. A blanket of coarse cotton cloth serves for a coat, and their long black hair is tied into a knot, just over the right temple, and the rest, apparently never combed, hangs over the shoulders and face. On their legs they wear cotton circlets below the knee, with brass rings to keep the coils apart. Many of them also wear necklets or torques of brass.

The dress of the women varies for the three groups, but the differences are not great. The chief garment is a gaberdine called *thindaing* by the Burmese, perhaps more like a poncho, since it is slipped over the head, and has either rudimentary sleeves or none at all. They also

WHITE KAREN TRADERS

The man on the left wears the national *thindaing* (see text, page 317), the one on the right a hybrid European suit, and those in the middle the ordinary coat and trousers of the Shan.

wear a short kirtle which reaches within a hand's breadth of the knee, but some dispense with this. It is red and blue in stripes (see illustration, page 314).

The women in the northern section of the Brè tract have brass tubing coiled round the leg from the ankle to the knee, and from above the knee to half-way up the thigh. The southern Brè women have to content themselves with cotton coils instead of brass. Both wear large brass hoops or torques round the neck, and enormous ear-plugs are fixed through the lobes of the ears (see page 320).

They have no head-dress, and their hair, which is as unkempt as that of the men, is tied in a knot at the back of the head. They marry very early—the girls at about thirteen, the youths at fifteen years of age.

THE HUSBAND SURRENDERS HIS FINERY TO HIS BRIDE

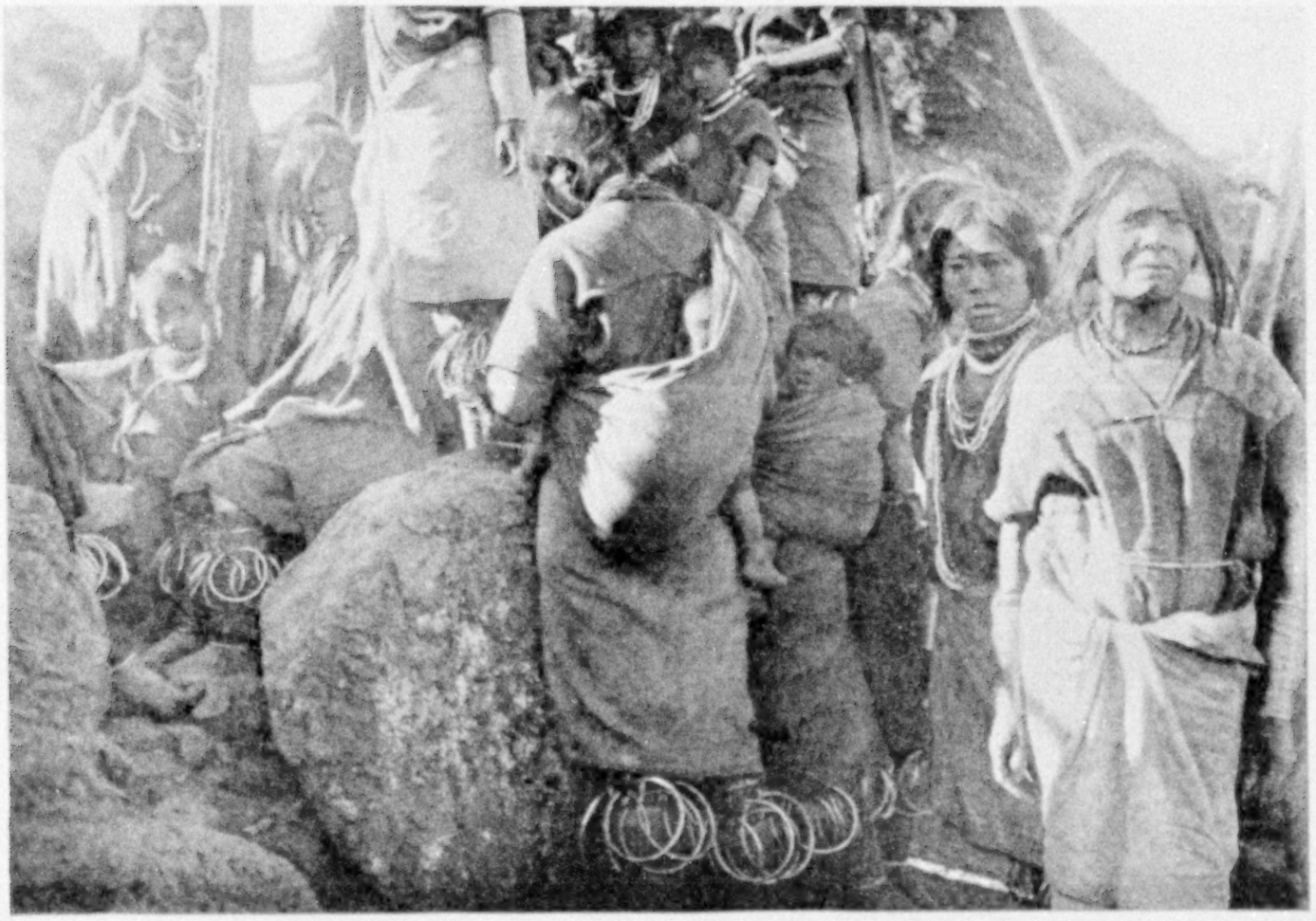
It is an easy matter to determine whether or not a man has a wife. The unmarried wear pebble necklaces which have been handed down from father to son for generations. Some of them are valued at fifty rupees, which is wealth for these hills.

Besides these, large brass rings encircle the man's neck, hang from the ears, and are inserted in the cotton garters on his legs. The northern Brè bachelor adds to these ornaments a twisted bamboo band round the head, studded with mother-of-pearl shirt-buttons or small red and green beads, as a sort of setting to the shards of large green beetles.

All this finery goes to the wife when he gets one, and as a husband he is reduced to a pair of trousers, a blanket, and some unornamented black rings round his legs. A rudely carved wooden comb sometimes remains fixed in his top-knot as an ornament, not for use.

Both sexes stain their teeth black, using for the purpose the leaves of a tree which the Brè call Thüpo, mixed with lime-juice.

The staining is a ceremonial performance. All the children of the village, at about the age of ten, are taken to a secluded thicket at sunset. They have to close their eyes, cover them with their



GAUNGTO WOMEN OF LOILÔNG VILLAGE

Note the leg-rings inserted in rattan garters. The weight of these rings frequently makes it so difficult for the wearers to get about that they use sticks for support. The members of another tribe wear tightly coiled brass rings around their necks, adding one and another from time to time, until their necks are elongated like a fowl and they cannot move them (see illustrations, pages 296, 298, and 307). Note the babies on their mothers' backs.

hands, and chew all night long. At daybreak they return to the village, and the result is inspected by the elders to the sound of castanets and a peculiar kind of bassoon made out of a buffalo horn. It is believed that if they open their eyes their teeth will take the color of whatever their sight falls on. That is why they go to the jungle; their minds might be distracted from the chewing in the village.

The rest of the Karen tribesmen of these hills form much smaller groups, but they all have their distinctive patois, due, no doubt, to the detestably rugged character of the country.

STRANGE MARRIAGE CUSTOMS

And they all, at least the women, have their distinctive peculiarities of dress. These are far beyond the complexities of rowing or lawn-tennis "blazers," and it would need a stamp-collector or the compiler of a biographical dictionary to catalogue them all.

One thing, however, is common to them all, and that is the strictness of their rules of endogamy. Only cousins or only the inhabitants of certain groups of villages may intermarry, and contracts of the kind have to be approved, and are usually arranged, by the elders of the village.

As soon as a boy has reached the age of puberty he has to go to live with the other unmarried youths in a barrack called the *Lubyo Haw*, the Bachelor Hall, which may be outside the village, but is usually in one corner of it. There he stays until he is married, and must not enter the house of his parents or talk to any of the young women of the village until that time (see page 310).

The limitations of possible alliances are so considerable that in some places there are many doddering bachelors in

WITH ALL HIS WORLDLY GOODS HE HER ENDOWS

The unmarried Brè man wears a pebble necklace which has been handed down from father to son for generations; large brass rings encircle his neck, hang from his ears, and are inserted in his cotton garters. All this finery goes to his wife when he gets one. The husbands of these two matrons were evidently well provided with such valuables when they renounced bachelorhood (see text, page 318).

the Bachelors' Hall and plenty of aged spinsters without a home of their own.

YOUTH OF 15 SOMETIMES TAKES WOMAN OF 70 FOR BRIDE

The only occasions on which lads and lassies meet are at marriage feasts and at wakes. These festivals last over three nights and are veritable orgies, with great excess in eating and drinking. Both sexes are well-seasoned vessels, since they begin drinking strong drink before they are weaned; but there are those who say that these gatherings are as scandalous as the agape which the Council of Carthage denounced as being no better than the Parentalia of the heathen.

This limitation of marriages to near relations results quite often in unions where husband and wife are of very unequal age, the husband fifteen, the wife seventy, or the other way about.

Punishment for marriage out of the clan was formerly very severe. A large hole was dug in the ground and a log placed across it, to which two ropes were attached. The ends of these were noosed round the necks of the offending pair. They were then made to jump into the pit, and so hang themselves.

This is no longer allowed, so they are excommunicated instead and never allowed to enter a Karen village again. The two villages of Kara in the Nan-kwo circle are said to be inhabited entirely by such eloping couples.

The Banyang or Banyôk Karens are of all the clans the most distressingly rigid in their endogamy. Marriages are only permissible between the occupants of the village, and the number of houses is under a dozen. In the days before the British occupation a hill official called a *Taung-sa* (literally hill eater) made an annual visit to the village to see that there should be at least one marriage in a twelve-month. Neither parents nor the principals were consulted; the Taung-sa simply ordered a couple to be married, and married they were, just as a man might be summoned to serve on a jury.

They were all officially gazetted alliances, so to speak, and the Taung-sa's fees were no more than two pots of liquor. The smallness of the village made the further condition that the bride and bridegroom must be cousins, less troublesome than it might have been if there were hundreds of houses in the village instead of a number that could be ticked off on the fingers.

UNWILLING BRIDEGROOMS KEPT UNDER GUARD

The neighboring villagers say that there is so little hint of inclination in the matter that the bridegroom has often to be taken by force to the bridal chamber. The Taung-sa's police have that duty, and having got him there they see that he stays for three days and three nights. The village always provides a bridal feast, which is of the usual hard-drinking kind. It may be, therefore, that the seeming want of gallantry on the part of the happy man is due to incapacity to go without help, or to a reluctance to leave while any drink remains. The bride carouses by herself on the nuptial couch.

There are some races in Australia and the South Seas that have similar rules, but their endogamy does not go nearly so far as this. The Banyangs have no laws against widows remarrying. They must do so, in fact, if the Taung-sa happens to order it. Since there is so much worry in marrying the people, it is not surprising to hear that divorces are absolutely forbidden.

Deep down in the Paunglaung Valley, on a river which in its later course is called the Sittang and flows into the sea between Rangoon and Moulmein, is a clan called the Mèpu. Its members are classed as White Karens and certainly show a link with the Sgaw and the Pwo. They have this tradition of their origin:

Hundreds and hundreds of years ago there were a brother and sister called Lanyein and Among. They lived at Ela, a village in the Pyinmana district north of Toungoo. They had a magic drum which supplied them with anything they wanted when it was beaten. One day Lanyein gave Among half a porcupine. Unfortunately it was the half with the quills, which pricked the girl in the hand, and she was very angry.

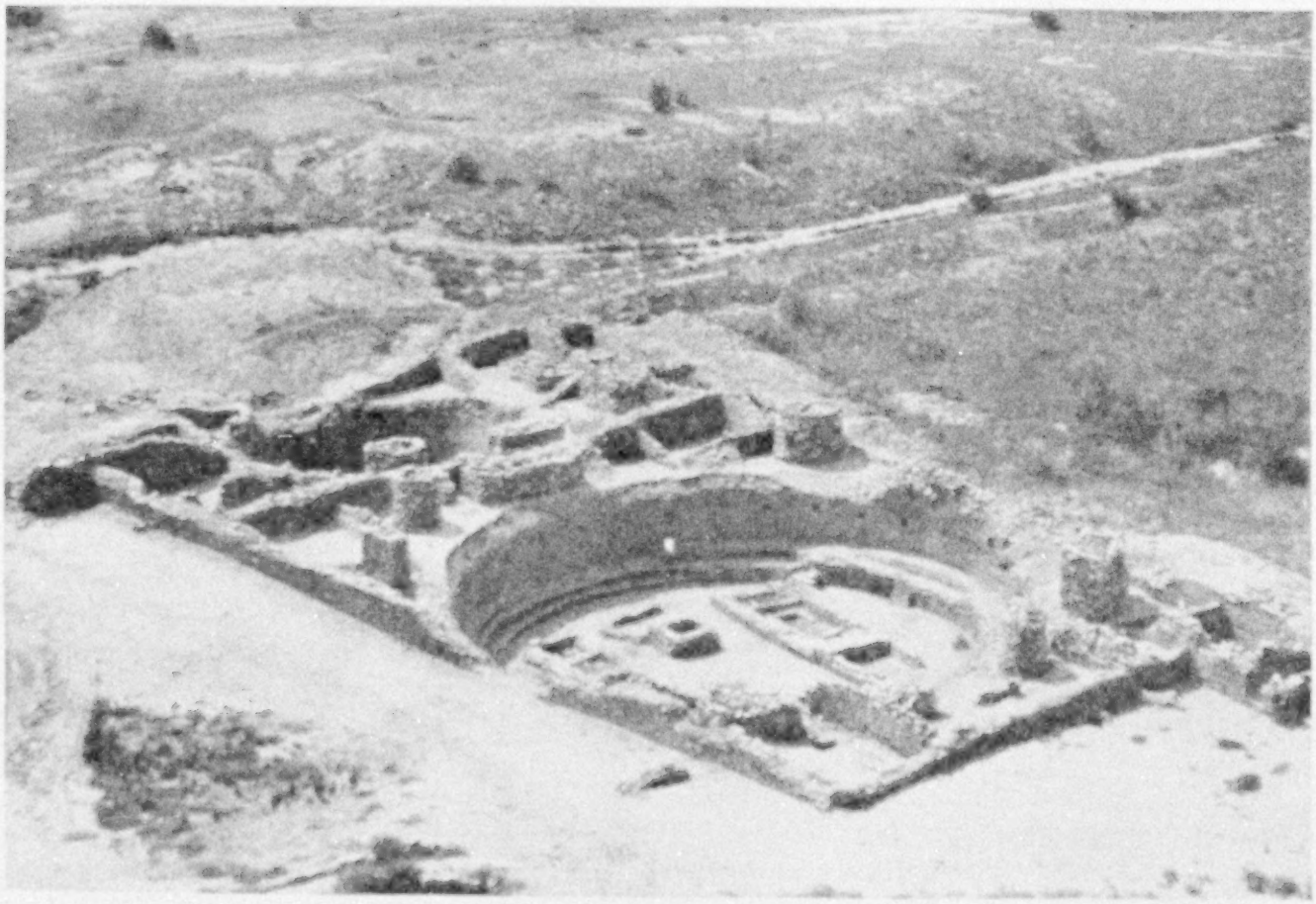
To revenge herself, she told her brother the drum needed a new skin. He followed her advice, with the result that the wish-drum became useless.

Lanyein then decided he must go away elsewhere, and set off accordingly without telling his sister. She started to follow him a day or two later, but when she got to a village called Maungla, she was worn out and stayed there. She married one of the villagers and the present Mèpu clan form her descendants.

Lanyein walked right over the hills into China. There he got a great name for his magical powers, and in time was chosen Emperor of China, Udibwa (Egg-born), as the Burmese and Shans call that potentate. In those ancient days the women of China wore brass anklet rings, and Lanyein sent his sister twelve of them as a present. They were so much admired that all the women took to wearing them.

The tale does not suggest any great imagination or narrative power, but it does hint at the original home of the Karens.

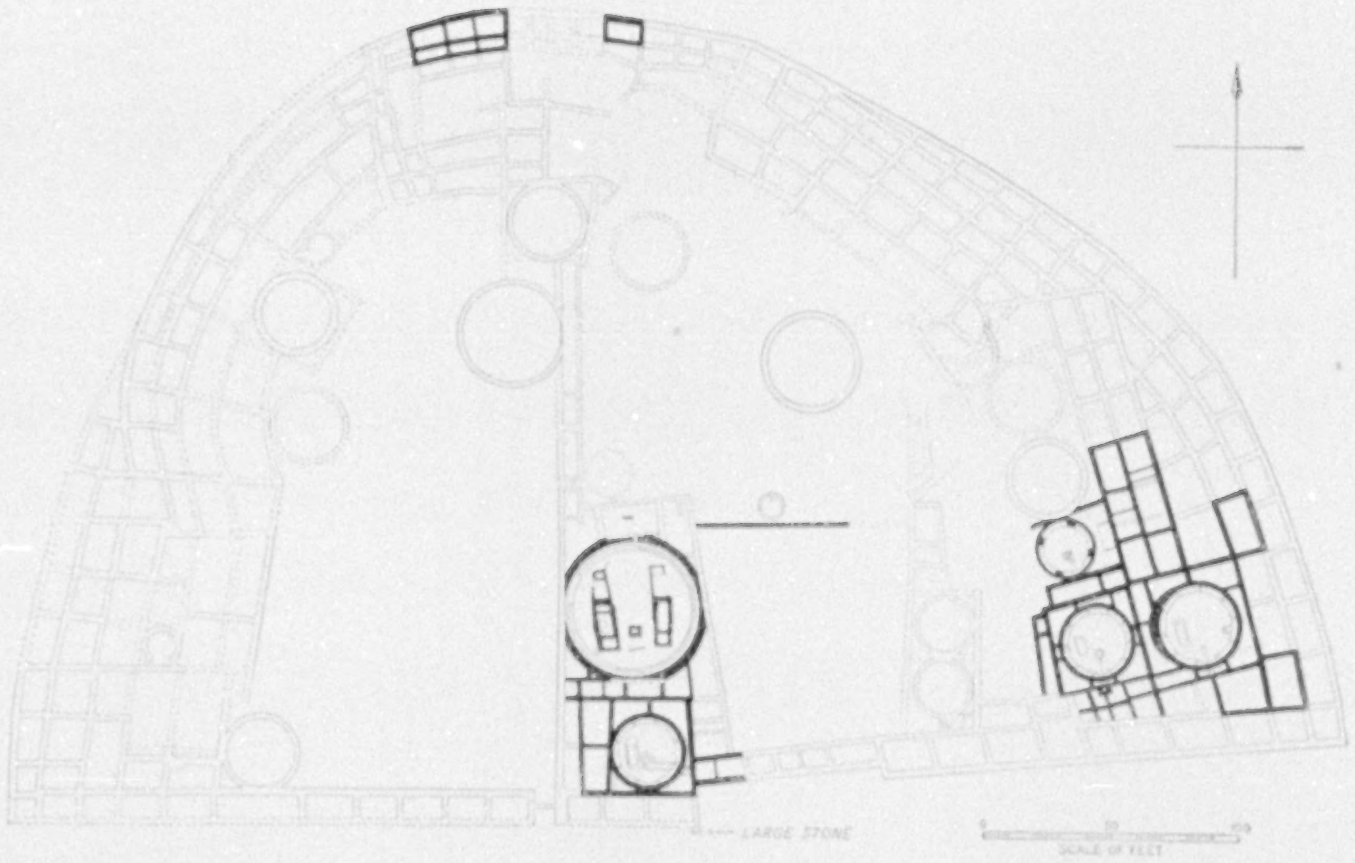
Notice of change of address of your GEOGRAPHIC MAGAZINE *should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your May number, the Society should be notified of your new address not later than April first.*



Photograph by O. C. Havens

THE GREAT KIVA OF PUEBLO BONITO, WITH ITS SURROUNDING ROOMS, VIEWED FROM THE NORTH CLIFF (SEE TEXT ON OPPOSITE PAGE)

This was the most important council chamber or ceremonial room of the Bonitians. The small hollowed square of masonry in the center of the room was the fireplace.



A DIAGRAM OF PUEBLO BONITO: THE BLACK LINES SHOW THE PORTION OF THE RUIN EXCAVATED BY THE NATIONAL GEOGRAPHIC SOCIETY'S EXPEDITION OF 1921

During the coming summer the 1922 expedition will continue its work on the ruins at the right, working in a northwesterly direction.

THE PUEBLO BONITO EXPEDITION OF THE NATIONAL GEOGRAPHIC SOCIETY

By Neil M. Judd

Leader of the National Geographic Society's Expeditions of 1921 and 1922

PUEBLO BONITO is a pre-Columbian village, now in ruins, situated in northwestern New Mexico. Its exact age is unknown, but there is an increasing hope that this will be closely approximated before our studies have been completed.

We might, I believe, assume with some degree of certainty that the village was occupied 1,000 years ago.

I do not mean to say that Pueblo Bonito was erected, or that it was abandoned, in the year 922 A. D. My thought is that if it had been possible for us to look down from the cliffs, say 800 or 1,200 years ago, it is likely we should have seen happy children at play on the housetops and their elders busy with varied activities in and about the village.

Pueblo Bonito is a colossal apartment-house, not the first of its kind, but one of the largest and best known at that early period. Its equipment, its furniture, is a bit out of date, to be sure, but many a city dweller of today would welcome the freedom of its spacious rooms (see diagram, page 322).

This aboriginal village or pre-Columbian apartment hotel was a whole community in itself, since it covered a little more than three acres and sheltered between 1,200 and 1,500 individuals. Roughly speaking, its foundations were approximately equal to those of the United States Capitol.

There were more than 300 rooms on its ground floor; its outer walls were four, perhaps five, stories high. Portions of fourth-story walls still stand. Its houses were terraced upward from two inner plazas or courts, like the magnified seats of an amphitheater.

The modern pueblo of Acoma, southwest of Albuquerque, New Mexico, possesses several features closely paralleling those of Pueblo Bonito. Its houses are in long rows, with a high wall on one side, unbroken except for small ventilators, and, opposite, stepped houses overlooking the plazas. Acoma is the oldest continuously inhabited settlement in the United States; its population has been estimated at between 1,000 and 2,000 when the Spaniards first attacked it, in 1540 (see illustration, page 324).

Our initial explorations, conducted during the summer of 1921, afford a reasonably accurate view of Pueblo Bonito. The building is semicircular. It is 310 feet north and south; its south face is 518 feet long. If stood on end, this wall would reach to the windows of the Washington Monument.

The twenty or more circular kivas (a kiva was both a council chamber and a religious sanctuary) border the two open spaces where public ceremonies were enacted. The clustered dwellings overlooking these courts furnished seats for gathered spectators, just as the housetops of Oraibi are now utilized during the Snake Dance and other native dramas.

The shaded sections of the diagram on page 322 mark most of the rooms excavated last summer, but tests made elsewhere disclosed buried structures not shown on this plan.

THE BONITIANS USED THREE TYPES OF MASONRY

One of the most important results of our first season's work was identification of three distinct types of masonry employed in construction of the pueblo.

In the north and northwest sections of the ruin, dwellings with very crude stonework are found. These houses formed the nucleus of Pueblo Bonito; their builders possessed a culture cruder and less artistic than that of the peoples who came later to join with them and who were largely responsible, we may safely assume, in the development of the great community whose shattered walls first attracted our attention and now command our admiration.

The outline of this more primitive settlement has not been wholly traced, owing to the fact that it was partially destroyed and built over as newer buildings were erected.

Photograph by O. C. Havens

CAMP OF THE NATIONAL GEOGRAPHIC SOCIETY'S 1921 PUEBLO BONITO EXPEDITION

Photograph by Charles Martin

THE MODERN PUEBLO OF ACOMA CROWNING A ROCK FORMATION SOUTHWEST OF ALBUQUERQUE, NEW MEXICO

This, the oldest continuously inhabited pueblo in the United States, possesses several features closely paralleling those of Pueblo Bonito (see text, page 323).

Photograph by O. C. Havens

THE SOUTHEAST SECTION OF PUEBLO BONITO (NORTHWESTERN NEW MEXICO), SHOWING PART OF THE ROOMS EXCAVATED BY THE NATIONAL GEOGRAPHIC SOCIETY'S 1921 EXPEDITION

The partially razed camp of the 1921 expedition is seen in the upper right-hand corner. The 1922 expedition will leave Washington in a few weeks to pursue its work of excavation and exploration. The vast ruins were occupied a thousand years ago by perhaps 1,200 or 1,500 individuals (see text, page 323).

Photograph by Charles Martin

THE HOPI VILLAGE OF WALPI, WHOSE TERRACED HOUSES STAND OUT AGAINST THE BLUE ARIZONA SKY LIKE AN ANCIENT RUIN

This is the most picturesque of the Hopi towns, and some of the clans of this tribe of Indians are known to have migrated from cliff dwellings such as those to be found on Mesa Verde, Colorado. The Zuñi Indians say the Hopi people built the great houses of Chaco Canyon (see text, page 329).

The illustration on page 328 shows the three principal types of masonry—the oldest, the latest, and the intermediate.

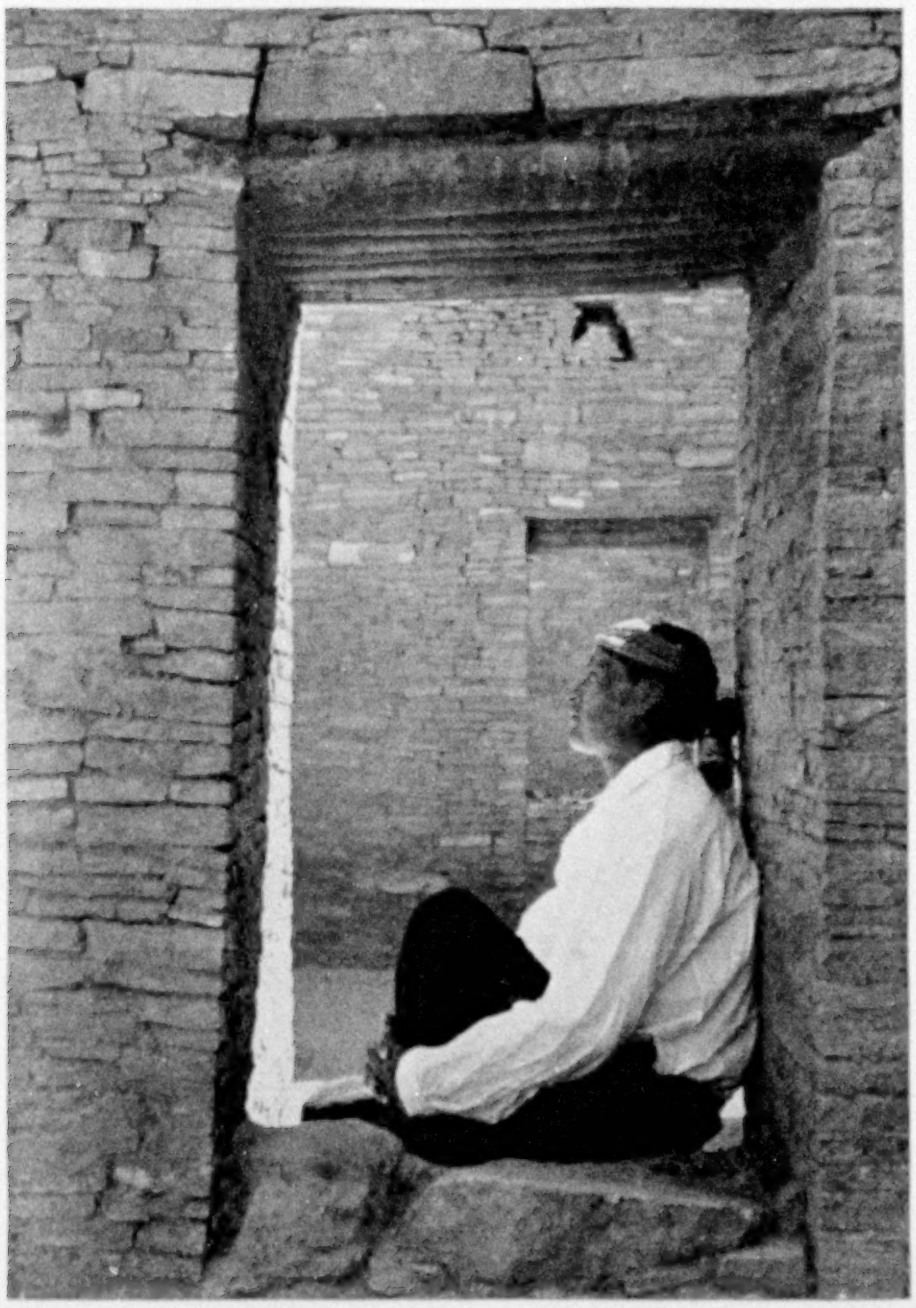
Whenever one of the old Bonitians got a new idea, he set about its realization, even if this meant destruction of the house he had erected with infinite labor. Beneath a large majority of the 40-odd rooms excavated during the summer of 1921 we found the razed walls of still older houses.

The excellent example of the second type of masonry shows blocks of friable sandstone rubbed smooth on the face, laid in adobe mud, and chinked with innumerable small chips.

Walls of the later period are of laminate sandstone, laid close together and frequently with larger blocks placed to form decorative bands.

These variations in masonry can mean only this: Irresistible influences were at

work, asserting their supremacy. But whether these influences represent merely local developments or culture phases introduced by new comers is a problem we have yet to solve. We know that peoples from other regions came to dwell at Pueblo Bonito, for we have found numerous examples of their characteristic arts.



Photograph by Neil M. Judd

PERHAPS AMONG THE TRADITIONS OF HIS PEOPLE THE SOLUTION OF THE MYSTERY OF PUEBLO BONITO WILL BE FOUND

This Zuñi boy may be a descendant of the aboriginal artisans who quarried the stone and mixed the mud that went into the towering walls of Pueblo Bonito (see text, page 330).

DIFFICULTIES AND REWARDS IN PUEBLO BONITO RESEARCH

This work of exploration, this digging into deep rooms, this ferreting out of hidden facts, has its difficulties and its rewards.

The chief recompense is the satisfaction one derives from adding a few sentences to the world's history, in contributing even a short paragraph to the story of human progress. There is an immeasurable joy in starting work on a gigantic rock pile—the accumulation of fallen walls and centuries of wind-blown sand—and finding, after a few hours' labor, a whole series of ancient dwellings unfolding itself.

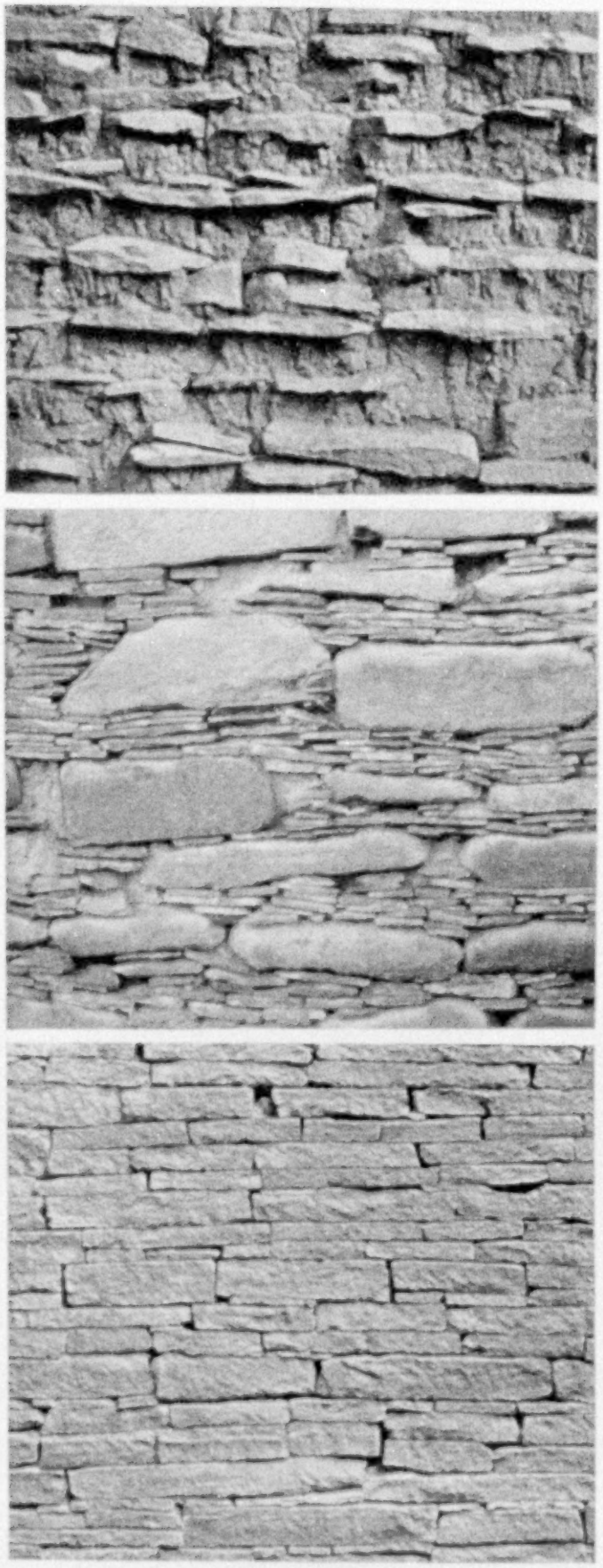
Fragments of information, constantly being uncovered, hold one to the task. Teams can be used upon occasion, where the amount of earth to be removed exceeds the quantity of stone, but difficulties increase in proportion to depth, and the uninitiated can scarcely realize the problem of clearing deep rooms beneath interlocked and, often, insecure walls.

WAR CLOUDS OFTEN DISSIPATED WITH CANDY

Early spring months in desert canyons of the Southwest are notorious for their sandstorms, and our camp was exposed to all the winds that blew, no hidden corner being safe from permeating dust clouds. In direct contrast, midsummer brings the rainy season, when everything, even one's sense of humor, gets wet and soggy.

The sandstorms were a daily torment throughout the greater portion of the summer.

It was a weird sight indeed to see a cloud of flour-like sand rolling over a distant cliff and up the canyon on the very heels of a saturating shower. Nothing



Photographs by O. C. Havens

THREE TYPES OF PUEBLO BONITO MASONRY

Each of the sections photographed is two feet square. Crude stonework (see top) is found in the oldest portion of the ruin. The middle picture shows a second type in which sandstone blocks, rubbed smooth on the face, and small, thin chips are characteristic. The latest masonry (at the bottom) consists of rather uniform fragments of laminate sandstone laid close together (see text, pp. 323, 326).

escaped this dust; it found a way beneath watch crystals, into locked trunks, and, worst of all, into food served by an incomparable cook.

During the first busy weeks in camp and before our tardy tents arrived, sand showered down on piles of equipment like a fog of pumice thrown out by that greatest spewer of all, old Katmai.* For partial protection the camp stove was dragged to a neglected dugout fresh with the unmistakable odor of Navaho goats; then a rude screen was raised, and still later the front of the shed was completely closed.

Happily, the intensity of these periodic storms decreased as the season advanced, but the smell and the taste of them remained to the very end.

Early and late, each day ushers in its own problems in the work of excavation, and there is also the ever-threatening possibility that one or more amiable-looking Indians will flare up over some imagined injustice, causing temporary mutiny in the ranks. War clouds have been dissipated more than once with a handful of cheap candy or a five-cent bag of imitation tobacco. I am a firm believer in the efficacy of the lowly gumdrop and the pipe of peace.

And then there is the mother-in-law question. I suppose no previous expedition of the National Geographic Society has been made the victim of the famous mother-in-law joke; but the Navaho have a belief that a man becomes blind if he looks upon his wife's mother. The tradition has its obvious advantages and its disadvantages. If during the working day the mother-in-law of one of our Navaho men happened to pass, the latter abruptly turned his back or dropped his shovel and pulled his shirt over his head, simulating a hiding ostrich, until she had disappeared.

THE ANCIENT BONITIANS WERE TRUE NEIGHBORS

The ancient Bonitians were agriculturists by choice—permanent habitations were erected only by sedentary, agricul-

* See accounts of Mt. Katmai and the Valley of Ten Thousand Smokes in the NATIONAL GEOGRAPHIC MAGAZINE for February, 1913, January, 1917, February, 1918, and September, 1921.

turally inclined peoples—and yet a portion of their food supply was obtained by hunting the deer, the antelope, and the wild turkey.

They were true neighbors to each other and had developed the community spirit to a high degree. Locked doors were unknown in Pueblo Bonito. As an example of the coöperative spirit which prevailed, I would cite the skeleton of a mule deer, fragments of which were found in a dozen different rooms. The animal had been killed by one or more hunters and its flesh distributed among the immediate neighbors.

Construction of Pueblo Bonito was a community enterprise. Gathering the stone, bringing mud and water, and transporting the huge beams that roofed the dwellings were tasks shared by its inhabitants.

The garden plots tended by the menfolk were considered town property; the whole village united in planting and harvesting the principal food crops. Corn, beans, and squash were raised, but the Bonitians depended, also, upon seeds from the wild grasses which carpeted their sandy mesas.

The village was governed by regularly chosen representatives, who met in the kivas and transacted their business under protection of supernatural beings.

PUEBLO MYTHOLOGY MAY HELP TO SOLVE MYSTERY OF BONITIANS

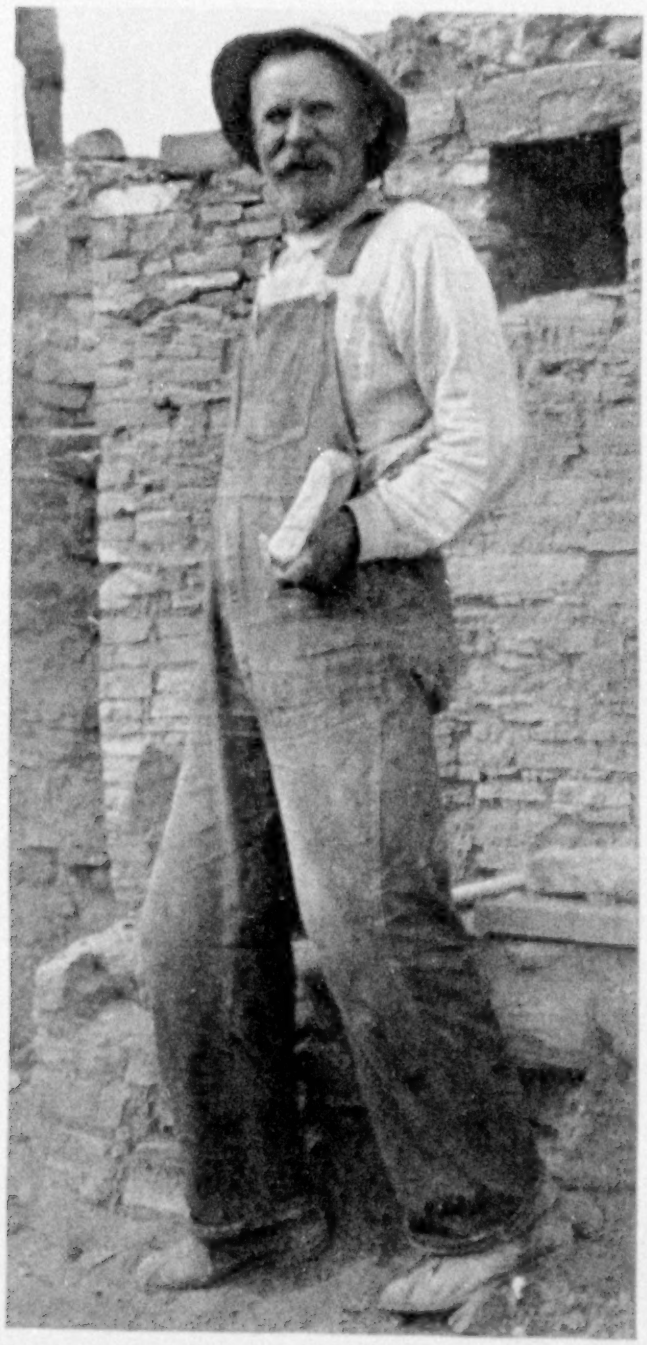
We do not know where the original settlers came from; their origin has not yet been traced definitely. Research will determine this in time; but there is another source of information to be drawn upon. I refer to the mythology of inhabited Pueblo villages in New Mexico and Arizona.

The modern pueblos, as we know them, are made up largely of previously unrelated groups, brought together for common defense against ancient enemies and, later, against the Spanish conquerors of the 16th and 17th centuries.

During recent excavations at Hawikuh, one of Coronado's "Seven Cities of Cibola," remains were found of a still older ruin, in which certain features are not unlike those in Chaco Canyon pueblos.

Acoma, on its lofty pedestal, may hold an important clue for us. It is the oldest inhabited village in the United States, and I have already mentioned certain architectural similarities between its dwellings and those of Pueblo Bonito.

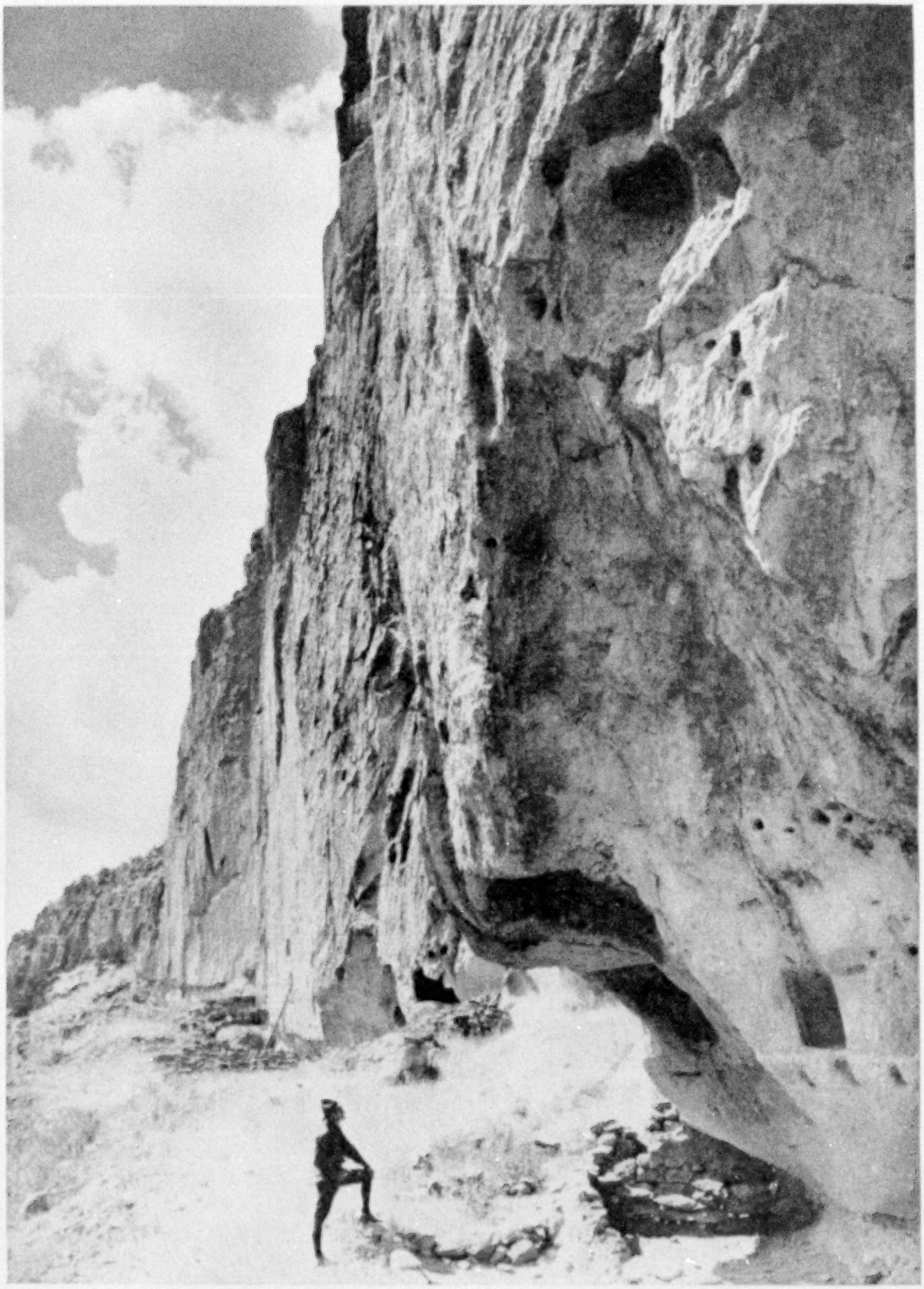
It may be that our solution will be found in Walpi, most picturesque of the Hopi towns (see page 326). My Zuñi workmen, perhaps in an effort to shield their own traditions, expressed the belief that Hopi peoples had built the great houses of Chaco Canyon. There may or may not be a basis for this assertion, but



Photograph by Neil M. Judd

HE DUPLICATES PREHISTORIC MASONRY

Jack Lavery was intrusted with the important task of repairing the shattered walls of Pueblo Bonito. His genial smile and his skill in imitating accurately the handiwork of ancient artisans won him the Zuñi name "Enote Nahme"—Prehistoric Grandfather.



Photograph by Charles Martin

IN THE "LITTLE CANYON OF THE BEANS"

The canyon is located northwest of Santa Fé, New Mexico, within easy automobile distance, and is visited by many tourists. Ancient peoples of this valley carved with stone implements small rooms called "cavate lodges" in the sheer cliffs of tufa, and were therefore under no compulsion to construct elaborate community houses such as are to be found at Pueblo Bonito.

Photograph by O. C. Havens

CAUGHT IN THE QUICKSANDS

The expedition car was caught in Chaco Canyon quicksands one Sunday afternoon when on exploration duty, and this photograph was taken while waiting for an Indian runner to fetch help. After six hours' strenuous work the machine was rescued through the united efforts of ten men, a team of horses, and a second truck; once on firm ground, it returned to camp (see illustration, page 324) under its own power.

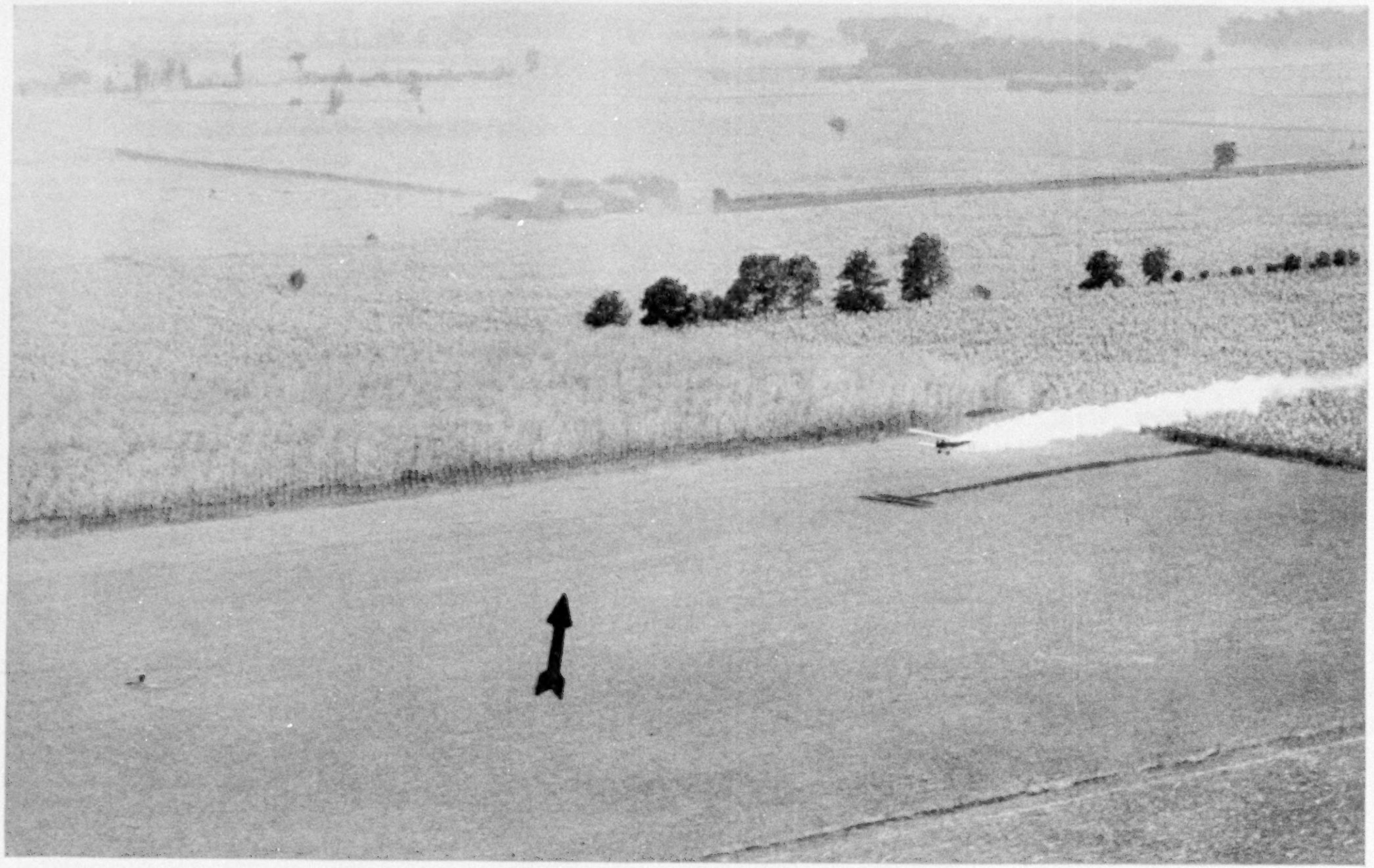
some of the Hopi clans are known to have migrated from cliff-dwellings in the San Juan drainage, among which those of the Mesa Verde stand supreme. The characteristic pottery of this region has been found among the later dwellings at Pueblo Bonito.

The Navaho possess a questionable myth that their ancestors attacked Pueblo Bonito, driving out its inhabitants, who fled to Zuñi. Native historians may hold the key to our problem, but only time and an absolute confidence in a friendly questioner will separate it and them. Who knows but what the Zuñi boy shown on page 327 is a descendant of the aboriginal artisans who quarried the stone and mixed the mud that went into the towering walls of Pueblo Bonito?

On long winter evenings, in modern pueblos, the boys gather around the old men, bask in the warmth of an open fire, and draw forth tales of "the people who used to be." These stories form the unwritten histories of various groups; they trace clan migrations from ancestral homes; they hold the heart-burnings of peaceful village folk, exiled by threatening blows from an enemy tomahawk.

How easy it would all be if we possessed the far-seeing eye of tribal heroes; if we could only picture the scenes that have been witnessed from the ancient watch-tower which still stands sentinel over the ruins of Pueblo Bonito.

Once we possess the outlines of such myths as may still exist, the cultural objects now deeply buried beneath the crumbling walls of the Beautiful Village will take on a new meaning and a new value. With these objects we can retrieve the unwritten records of Pueblo Bonito and establish for this greatest of all our pre-Columbian ruins in the United States its true relationship to the human history of the New World.



Photograph by Captain A. W. Stevens

LAYING DOWN A POISON POWDER BARRAGE AGAINST CATERPILLARS

Flying at the rate of 80 miles an hour, at an altitude of from 20 to 35 feet and on a line parallel with and 53 yards to the windward of a catalpa grove. A wind, varying from 8 to 11 miles an hour, was blowing in the direction indicated by the arrow. The grove lies directly ahead of the point of the arrow, and is surrounded on the two sides by fields of growing corn. This, as well as the following pictures of the machine in action, was taken from an accompanying plane.

FIGHTING INSECTS WITH AIRPLANES

An Account of the Successful Use of the Flying-Machine in Dusting Tall Trees Infested with Leaf-Eating Caterpillars

By C. R. Neillie and J. S. Houser

IN THESE very modern times one should be prepared to expect the unusual, but to be told upon inquiry for a man at his office that "He is up in the air; I don't know when he will come down" is so ultra modern that the average person would be taken somewhat aback.

Such, however, was the experience of the writers one day last summer during the course of the work herewith reported. And after a short time, the one for whom inquiry was made did safely "come down." This was Lieutenant J. A. Macready, Acting Chief of the Flying Section of the Government's Aviation Experimental Station at McCook Field, Dayton, Ohio,—the man who piloted the machine which was an epoch maker in the annals of insect warfare.

THE ADVANTAGES OF AIRPLANE OVER ENGINE-DRIVEN PUMPS

Heretofore the usual method of controlling leaf-eating insects affecting tall trees has been by the use of liquid poisons sprayed on the trees by means of engine-driven pumps, these outfits having reached their present development in the New England States in combating the gypsy and brown-tail moths and elm-leaf beetle.

However, the difficulties encountered in spraying very tall trees with liquids are legion, particularly when the trees are situated on ground so uneven that the spraying machine cannot be operated in their immediate vicinity. In such instances it is no uncommon thing to use several thousand feet of hose, and since this must be dragged about over the area under treatment, the labor cost of operating under such conditions is enormous.

Moreover, progress is so slow that it is not always possible to cover the infested area at the time when the application would be most effective from the standpoint of insect control. Dusting by airplane at least gives promise under some conditions of overcoming a few of these difficulties.

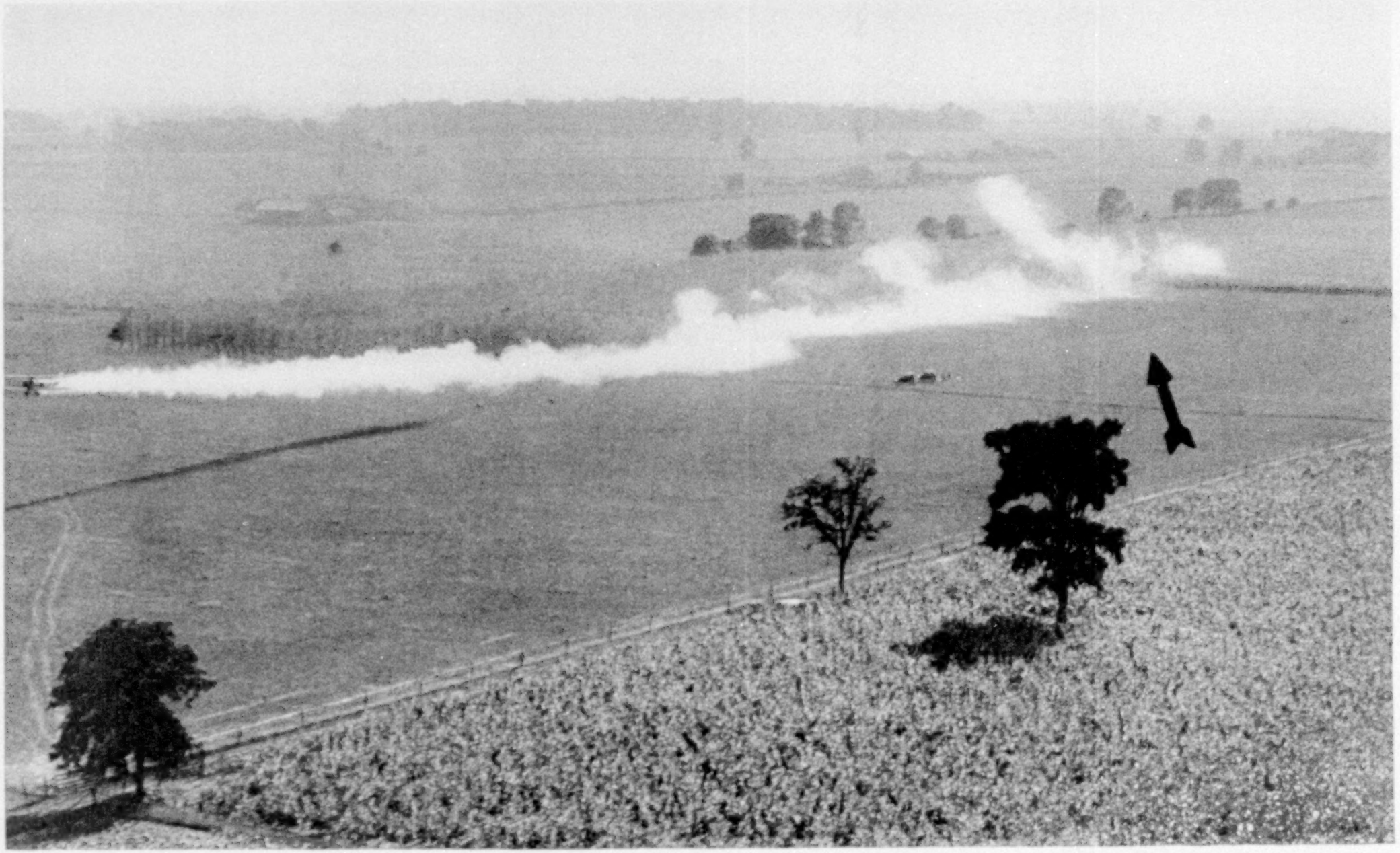
Early in the spring of 1921 the authors began seeking an opportunity to conduct a practical test of the airplane as a distributor of insecticides. In a few instances the plan was received with favor; in others it was considered a theoretical, impracticable and foolish undertaking and from many sources much good-natured chaffing was endured. Finally, however, a coöperative project was arranged with the officials of the Federal Aviation Experimental Station at McCook Field, Dayton, Ohio.

These officials entered into the spirit of the undertaking in a whole-hearted manner, giving it priority over everything in the Field for one entire day. Those chiefly concerned were: Major T. H. Bane, Director of McCook Field; Major H. S. Martin, Chief Engineer, and his assistant Mr. E. Darmoy, who designed the hopper to carry and distribute the poison and who operated the mechanism during the flights; Lieutenant J. A. Macready, Acting Chief of the Flying Section, who piloted the plane, and Captain A. W. Stevens, photographer, who made a remarkable series of photographs of the dusting plane in action.

A WAR DECLARED ON A NIGHT-FLYING MOTH

Originally it was planned to conduct the test in the spring of 1922 against the canker worm in the vicinity of Cleveland, Ohio, but almost simultaneously with the completion of plans for coöperative work with McCook Field, a much better opportunity for the test presented itself in the shape of an outbreak of the Catalpa Sphinx (*Ceratomia catalpæ* Bvd.) at Troy, Ohio, some twenty miles distant from Dayton.

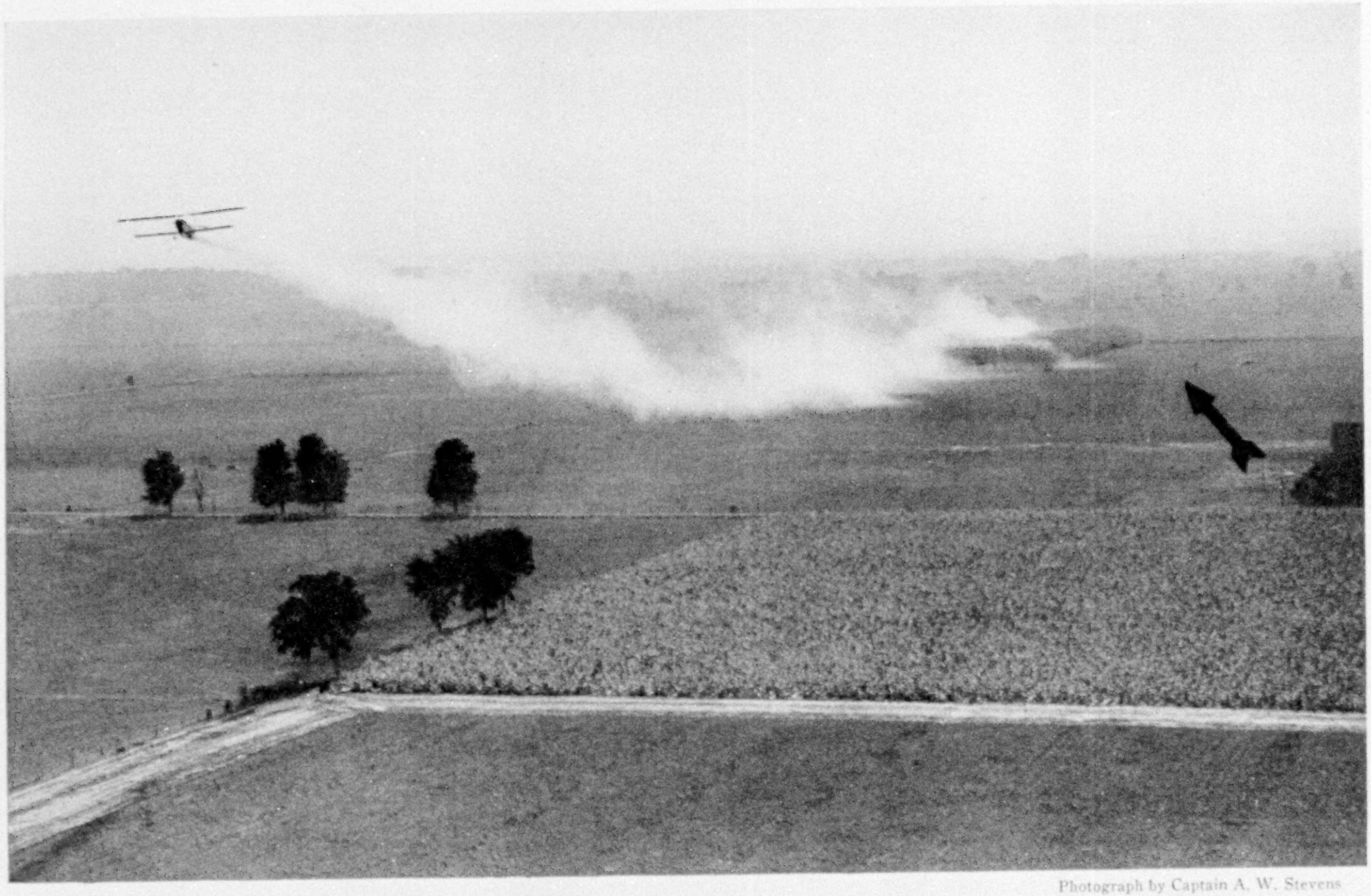
The Catalpa Sphinx is, in the adult stage, a large night-flying moth which lays its



Photograph by Captain A. W. Stevens

THE DUST CLOUD INVADING THE GROVE

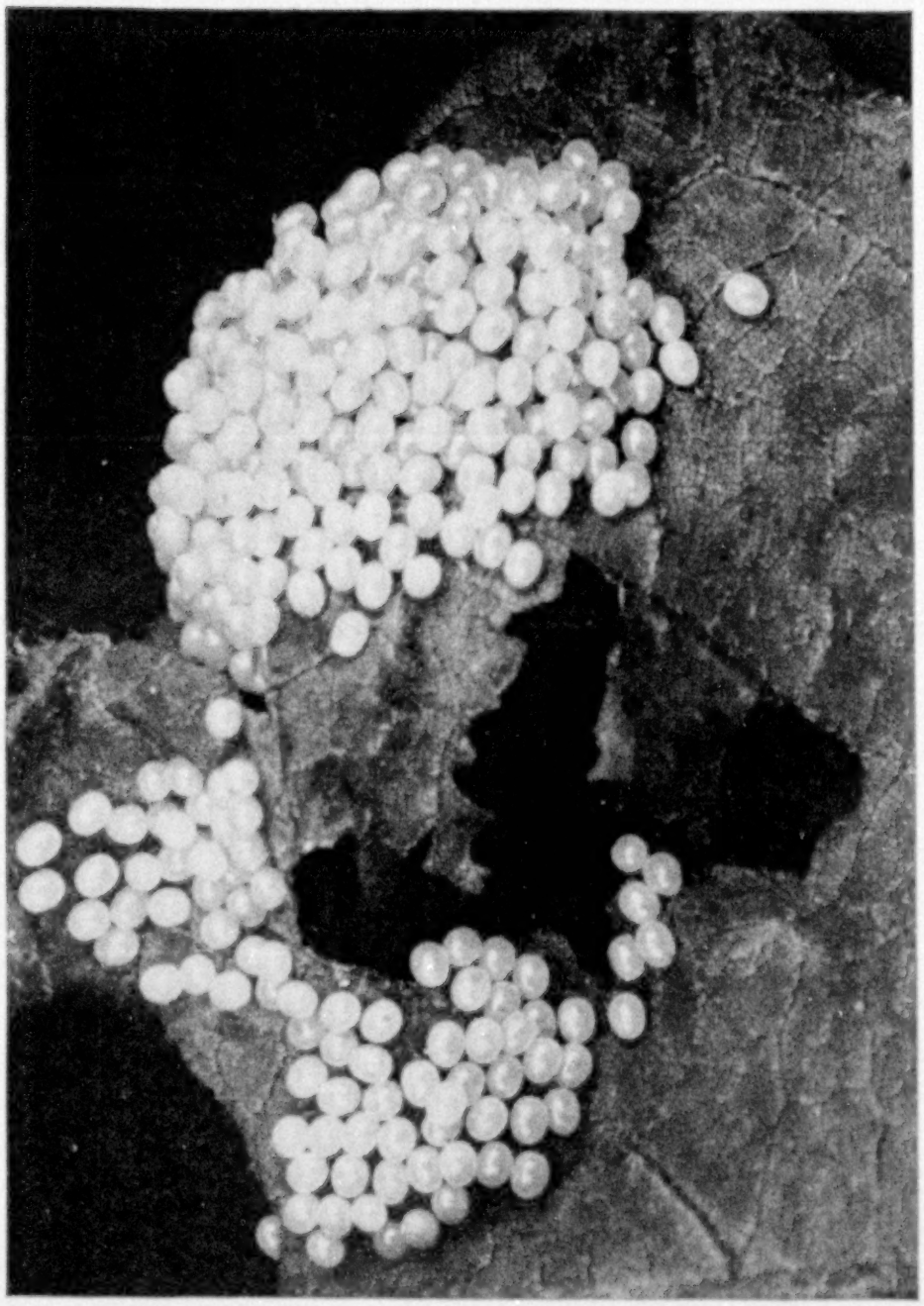
A three-angled battle was waged for the control of the dust after the release of the poison powder from the airplane. Gravity tried to pull it down; the "booster currents" (see text, page 337) tried to toss it upward, and the surface stratum of air or wind blowing in the direction indicated by the arrow endeavored to carry it over and through the grove. The last named of the combatants won, for the entire grove was covered by the dust.



Photograph by Captain A. W. Stevens

THE DUST CLOUD OF POISON POWDER TRAVELED COMPLETELY OVER THE GROVE

The success attending the initial effort to use the airplane in fighting destructive insect pests gives rise to the hope that the method may be extensively developed.



Photograph by Y. K. Roots

THE EGGS OF THE CATALPA SPHINX (ENLARGED) DEPOSITED ON A CATALPA LEAF

Each mother moth is capable of laying several hundred eggs. As many as a thousand have been taken from a single egg-mass.

eggs in pearly white masses on the leaves of the catalpa tree. These eggs within a few days give issue to tiny larvæ which feed upon the foliage and upon reaching maturity are as much as three inches long. They then pass to the ground, burrow down about three inches and transform to the pupal stage.

From these pupæ emerge the adult moths, which proceed to lay their eggs for another brood of destructive caterpillars. Only about a month is required to pass through the stages from egg to moth.

Last year there occurred in Ohio three full broods or crops of the caterpillars, each sufficiently numerous to defoliate completely the grove in which they appeared. Some groves put out three full crops of foliage and each in its turn was wholly consumed by the ravenous worms.

Our work was directed against the second brood of caterpillars working on the second crop of foliage.

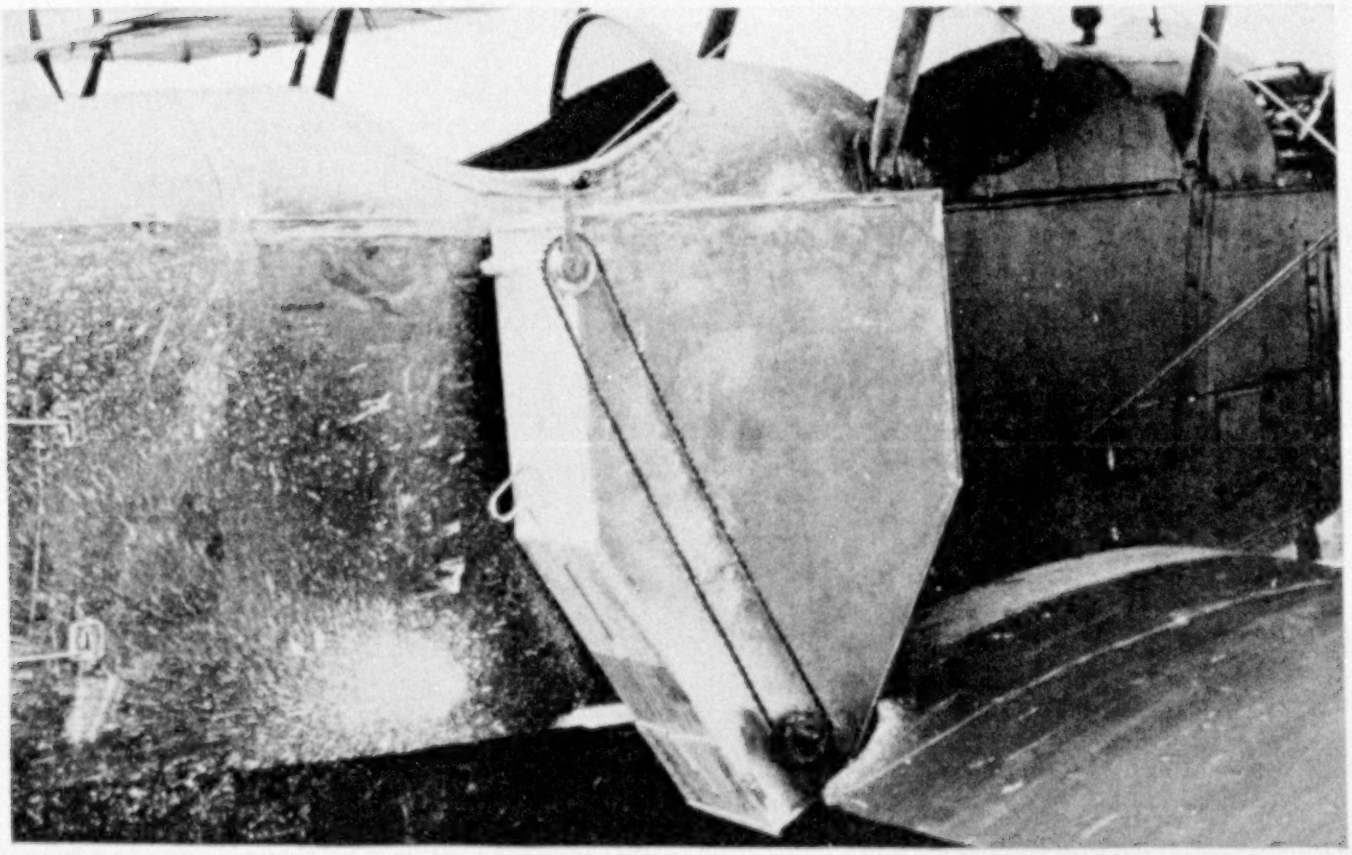
THE POISON POWDER RELEASED IN A DENSE CLOUD

The plane used was a Curtis J N 6 equipped with a hopper for carrying and liberating the poison powder. This hopper was secured to the fuselage of the plane by the side of the observer's seat. It consisted of an irregularly shaped flat metal box with a capacity for holding a little more than 100 pounds of dry arsenate of lead powder.

At the bottom was arranged a sliding gate, operated by a handle accessible to the observer in the plane. At the top of the hopper was a crank, connected by a sprocket chain to a revolving mechanism in the bottom, which when placed in motion dropped the poison powder through the previously opened sliding gate.

Immediately upon leaving the hopper the dust dropped into the "slip stream"—the violent air current set up by the revolving propeller—and was thrown into violent agitation in a dense white cloud which trailed out behind the moving plane as if the machine were on fire and belching large volumes of white smoke.

The catalpa grove in which the dusting was done was situated on level ground and had been planted for the growing of



Photograph by J. S. Houser

THE POISON POWDER HOPPER ATTACHED TO THE AIRPLANE FUSELAGE
(SEE TEXT, PAGE 336)

When the aperture at the bottom of the hopper is opened by pulling the looped wire handle upward, and the crank above is turned, the sprocket chain revolves a mechanism which throws the powder out. Upon its release from the hopper, the powder is seized by the "slip stream," the violent current of air from the propeller, and is immediately converted into a dense cloud of dust, which floats out behind the plane.

post and pole timber. It was a rectangular plot 800 feet long and 325 feet wide and contained approximately six acres. The trees, 4,815 in number, were from 25 to 30 feet tall.

The poison was applied between 3 and 4 o'clock on the afternoon of August 3, 1921, under almost ideal weather conditions. The atmosphere and sunlight were excellent for photographing and there was a steady wind varying from eight to eleven miles an hour. The direction of the wind is indicated by the arrows on the photographs.

EVERY TREE SPRINKLED WITH POISON

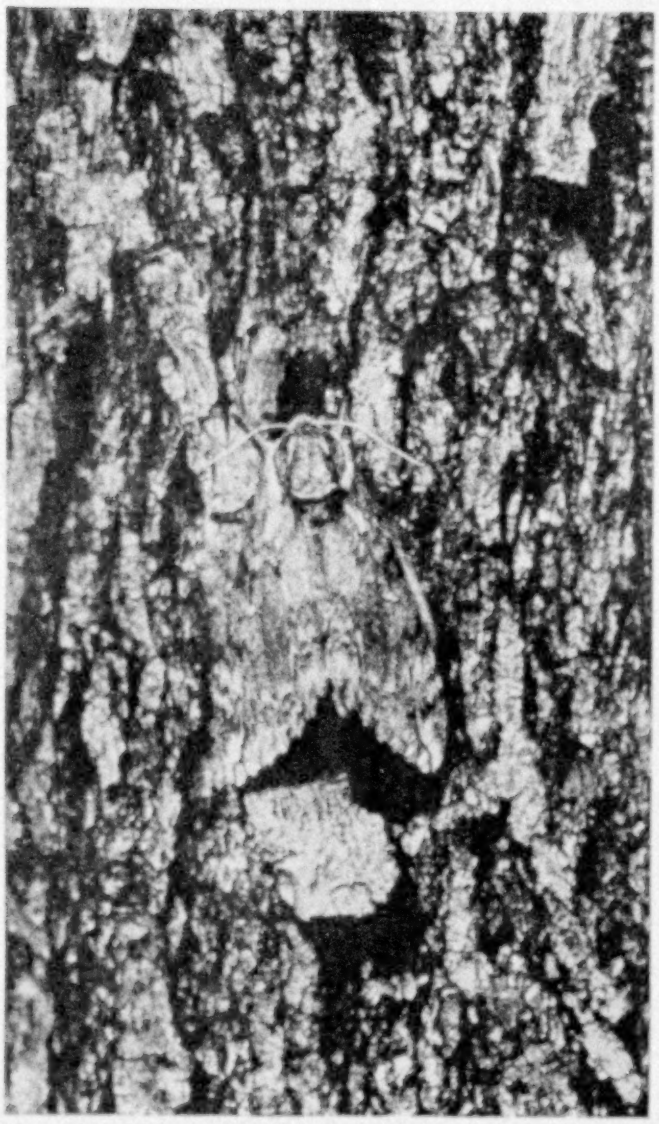
The plane flew at a speed of eighty miles an hour at an altitude of from 20 to 35 feet and in a line 53 yards to the windward and parallel to the grove. The dense cloud of poison dust thrown out behind the moving plane was grasped by the wind and floated through and over the grove, covering the foliage in its passage.

We feared that the dust might all settle on the trees in the immediate foreground, but to our surprise we observed that little currents of air which we termed "booster currents" were rising in the grove and these had a tendency to toss the settling dust cloud upward, whereupon it would be grasped by the wind blowing parallel to the earth's surface and thus carried onward, even to and beyond the far side of the grove.

Not a tree could be found, and many were climbed and examined, whose leaves did not bear particles of the deadly poison, easily detected by the unaided eye.

In all, the dusting plane passed the grove six times and distributed about 175 pounds of the poison. Since each passage required but nine seconds, the total time consumed in the actual work of dusting was 54 seconds, thus establishing a world's record for speed in applying insecticides to forest areas.

With a dust-liberating apparatus of greater capacity it would be possible to decrease the number of passages by the grove and thus lower still more the time



Photograph by J. S. Houser

THE ADULT CATALPA SPHINX MOTH ON THE TRUNK OF A TREE IS SCARCELY DISTINGUISHABLE

The gray-mottled wing coloring blends almost perfectly with the bark, presenting an excellent example of protective coloration.

requirement, and with experience in manipulating the plane in the application of the insecticide the amount of poison used could be reduced considerably.

POISON DUST WROUGHT HAVOC AMONG CATERPILLAR ENEMY

The outstanding feature of the application was the remarkable precision with which the poison could be placed at the point intended, thus dispelling the idea expressed by many before the test was made that the poison dust would be tossed willy-nilly by the air currents—wholly beyond control.

On the morning following the application of the dust some of the caterpillars were dead and many were ailing. Forty-six hours after the fog of dust had polluted their food, the evidences of the wholesale destruction of the insects were everywhere apparent.

Hanging on the branches and remnants of foliage, on fence posts and weeds; lying on the forest floor and secreted beneath its refuge were literally millions of the insects. Not a step could be taken without crushing numbers of them, some of which already had begun to putrefy.

Large sheets had been spread beneath the trees to record the dead caterpillars as they fell, but here again the photographic record is inadequate, for the dying insects had a tendency to use what strength remained to crawl off the sheet to die in seclusion. Nevertheless, on five square feet of one of the sheets 100 dead insects were counted.

The effect on the insects had far exceeded our fondest expectations. We had confidently believed that the smaller caterpillars would be killed, but had scarcely dared to hope that we would be able to kill the large larvæ, since it is a well known fact that the full-grown caterpillars are difficult to poison.

A careful investigation revealed the astonishing fact that not over 1 per cent of the caterpillars remained alive on the trees, and the minute observations and notes by the experts who witnessed the test preclude the idea that the destruction of the insects could be attributed to any other agency than the poison.

MAY BE ADAPTED TO FIGHTING COTTON PESTS

When one considers the success which attended the test, conducted as it was with crude apparatus and without the aid of a guiding experience in the manipulation of the machine, it seems certain that the airplane will be used successfully in the future to control forest insects.

Whether it will be possible to employ this method for the treatment of cotton or other low growing crops, or even in large fruit orchards which permit the economical use of terrestrial machines, remains to be seen. In the treatment of tall trees in park and forest areas the tremendous saving in time and labor in which its use results would seem to indicate that the method is wholly practicable.

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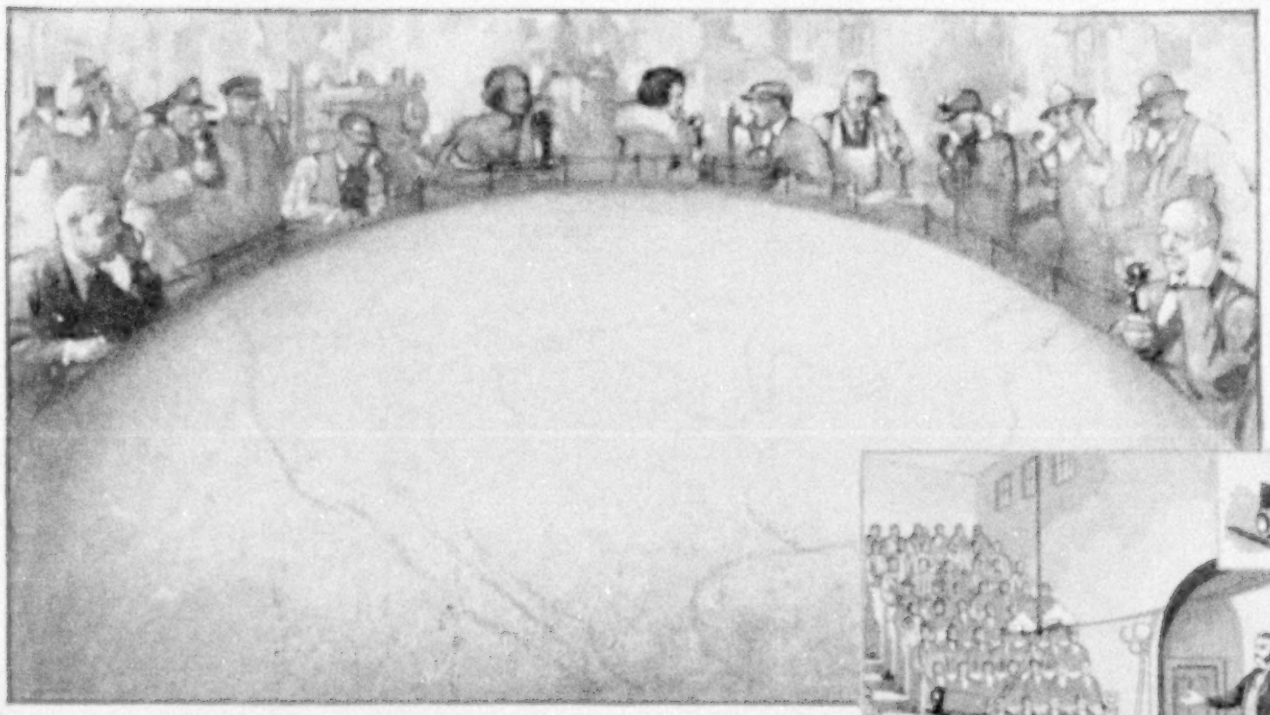

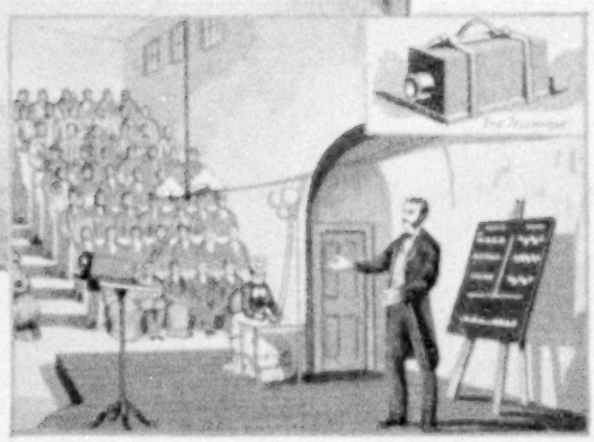

FORTY-THREE years ago Alexander Graham Bell, the inventor of the telephone, wrote this inspired forecast: "It is conceivable that cables of telephone wires could be laid underground or suspended overhead, communicating by branch wires with private dwellings, country houses, shops, manufacturers, etc., and a man in one part of the country may communicate by word of mouth with another in a distant place."

At the right, an old print of Bell lecturing on telephony, 1877.

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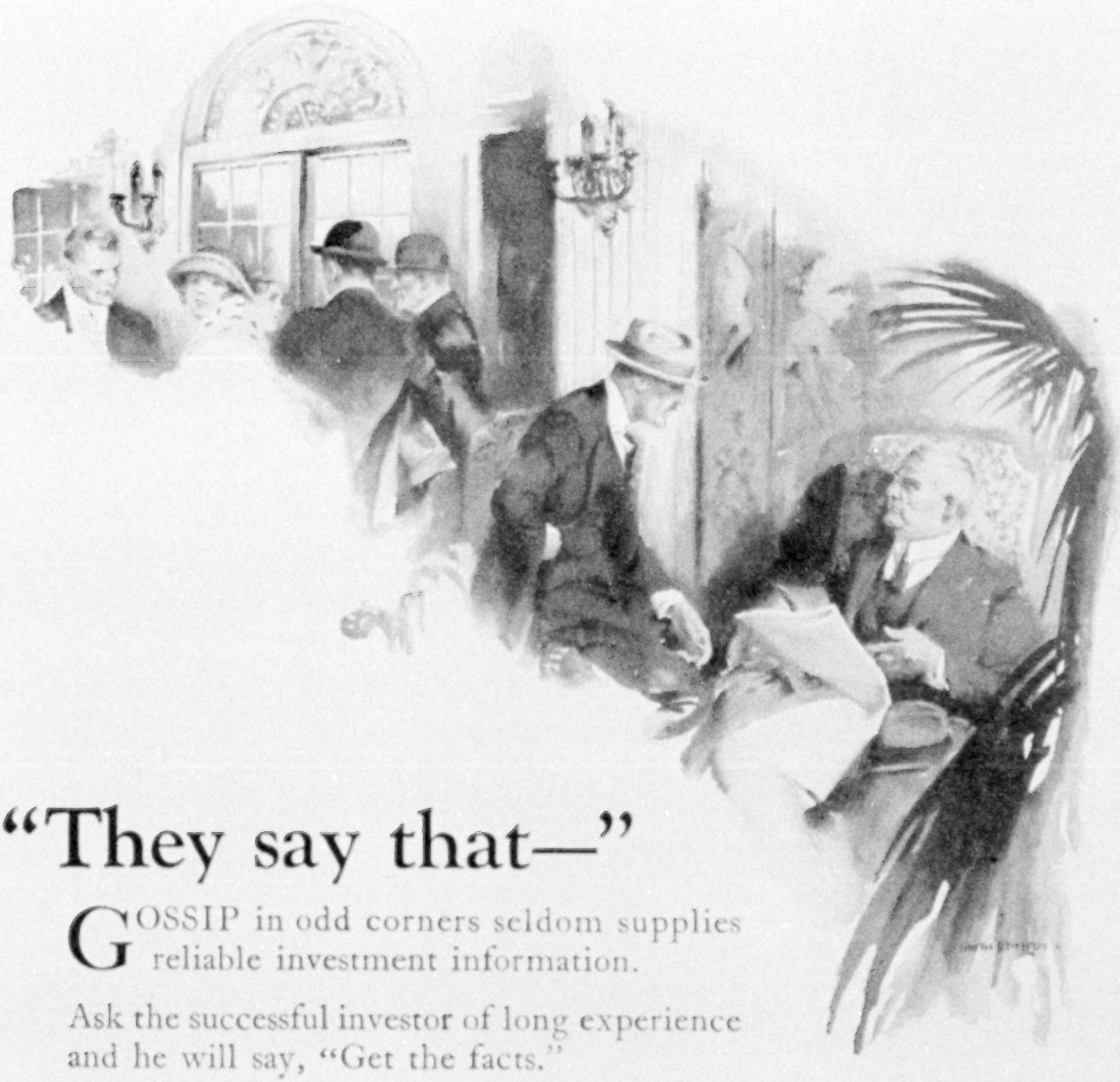

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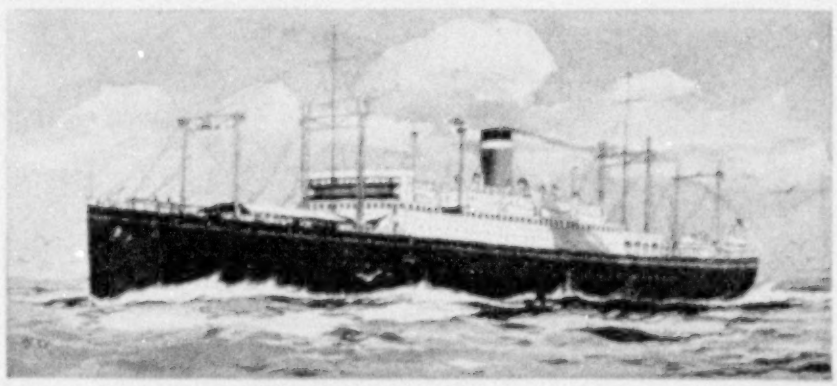

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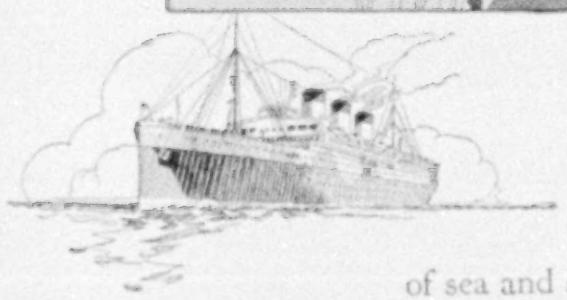
Voyages Modernes



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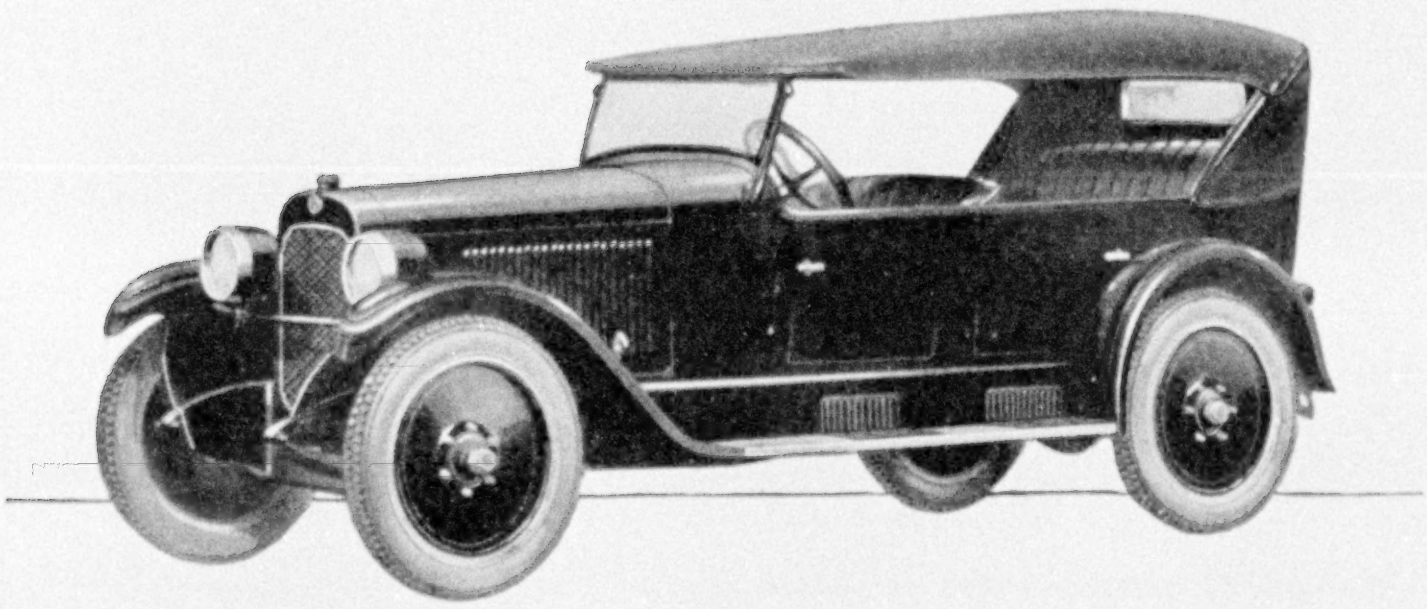

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Flexible to a degree.

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Again we offer, and urge you to accept, this new teeth-cleaning method.

Millions now employ it. Leading dentists, nearly all the world over, are urging its adoption. The results are visible in whiter teeth wherever you look today.

Bring them to your people.

The war on film

Dental science has declared a war on film. That is the cause of most tooth troubles. And brushing methods of the past did not effectively combat it.

Film is that viscous coat you feel. It clings to teeth, enters crevices and stays. Then night and day it may do serious damage.

Film absorbs stains, making the teeth look dingy. It is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea. Very few people have escaped the troubles caused by film.

Two film combatants

Now two combatants have been found. Many careful tests have proved their efficiency.

A new-day tooth paste has been created, and these two film combatants are embodied in it. The paste is called Pepsodent.

Now every time you brush your teeth you can fight those film-coats in these effective ways.

Another tooth enemy is starch. It also clings to teeth, and in fermenting it forms acids.

To fight it Nature puts a starch digestant in saliva. She also puts alkalies there to neutralize the acids.

Pepsodent multiplies the salivary flow. It multiplies the starch digestant in the saliva. It multiplies the alkalies. Thus these teeth-protecting forces, twice a day, are much increased.

See what the new way does.

Make this pleasant ten-day test and watch your teeth improve.

A few days will tell

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth whiten as the film-coats disappear.

Do this now. The effects will delight you and lead to constant delights. To all in your home they may bring new beauty, new protection for the teeth.

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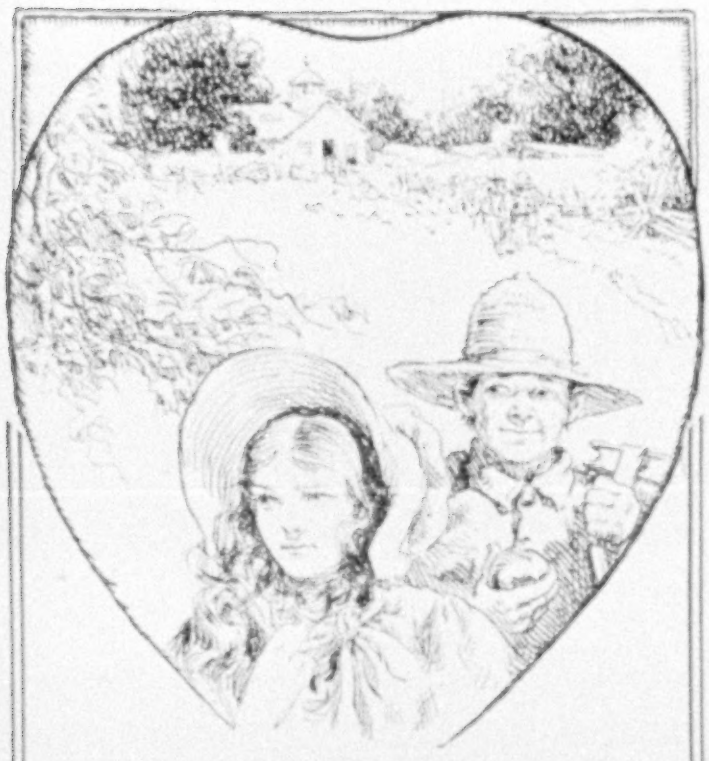
Only one tube to a family



"That Old Sweetheart of Mine"

"I can see the pink sunbonnet and the little checkered dress
She wore when I first kissed her, and she answered the caress
With the written declaration that, 'as surely as the vine
Grew round the stump,' she loved me—that old sweetheart of mine."

It's James Whitcomb Riley, of course. No other American poet ever touched simple human experience with the same wonderful sympathy and charm. He wrote a verse for every mood; he stirs every kindly emotion with his deeply sincere humor and pathos.

A little book containing five of Riley's most popular poems, one of his best humorous stories, and a brief sketch of his life and works has been published. It is offered without obligation to adult lovers of good literature to promote a wider knowledge of the

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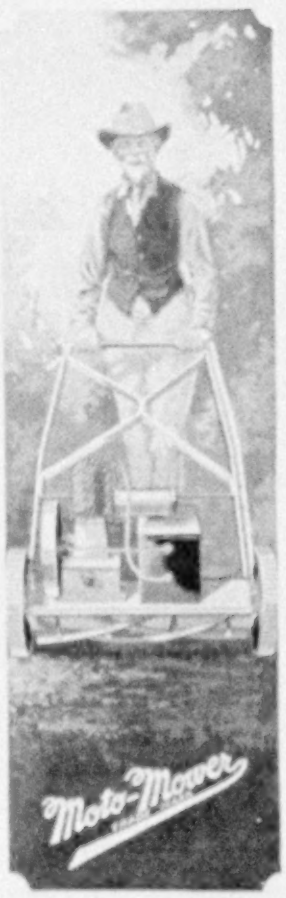

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Can you find the mistake or mistakes that are being made in this picture? Can you point out what is wrong?

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Recognized as one of the most dependable and reliable authorities on the conduct of good society, it has solved the problems of thousands of men and women. It has shown them how to always be well-poised and at ease, to meet embarrassing moments with calm dignity and what to do—what to say—what to write—what to wear at all times. The Book of Etiquette—two large volumes—covers dinner and dance etiquette—engagements and weddings—teas, parties, and entertainments of all kinds. Authoritative information on the wording of invitations, visiting cards, and all social correspondence. Each chapter is filled with interesting and valuable information that will enable you to become known as a person of poise and charm, one who can always be depended upon to know what to do under all conditions of social intercourse.

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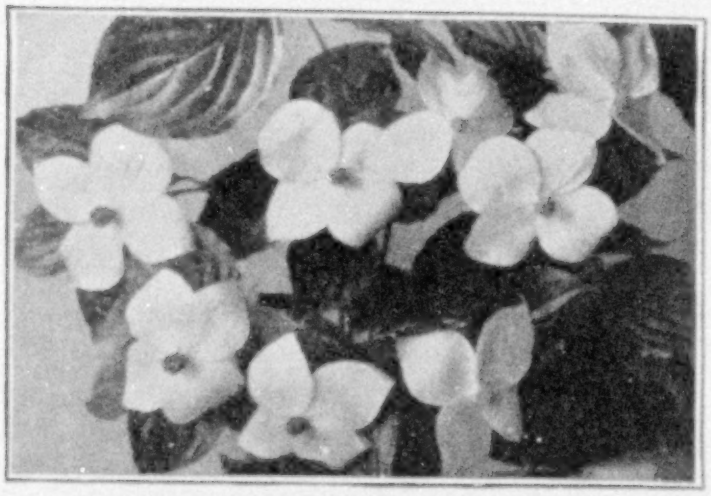

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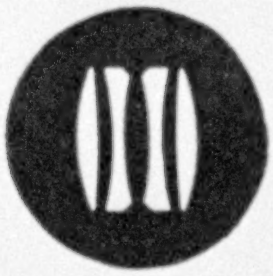

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Starting from the rough glass, the Kodak Anastigmat is Eastman made. The organization that makes the camera also makes the lens. Obviously, then, the lens expert does not have the generality "camera" in mind but rather a specific model of known capabilities in a specific size and with a specific shutter. The camera builder and the lens maker are aiming—not at a common target—but at a common bull's-eye.

As a result, on the camera to which it is fitted, any Kodak Anastigmat at its indicated speed is *at least* the equal in depth, sharpness and flatness of field of any anastigmat made, regardless of price.

The better you understand your lens, the better will be your pictures. You will find our little booklet "About Lenses" interesting—and worth while. It's free—and we should be glad to mail you a copy.

The KODAK ANASTIGMATS *f*.7.7 *f*.6.3 and *f*.4.5

Eastman Kodak Company
Rochester, N. Y.

Ten men were shipwrecked

Imagine them, after a few months, busy making new garments out of sail-cloth.

At least one man out of the ten will be sure to take more pains with his suit than the others, and his clothes will look better.

Why does he do it? Surely not to impress any one. Surely not to help him succeed.

But he'll do it—instinctively. Just because of some inner urge that makes him want something a little better than the ordinary.

This, we think, is exactly the same sort of impulse that makes people buy Old Hampshire Bond. We don't believe the men who prefer such a fine, distinctive paper do so simply through the vulgar desire for show, or the snobbish wish to "put it over" the other fellow.

Whenever we have met an Old Hampshire user, whether he were a millionaire or a man of moderate means, we have found a man of taste and appreciation—a man who likes fine things, who will wear a fine watch, grow a fine rose or own a fine car, if he can afford it, to please *himself*—and for no other reason.

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And because men of that type are usually successful in their affairs, you find Old Hampshire Bond preferred by thousands of successful business houses that are, after all, simply the expression of these men's characters.

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Old Hampshire Bond

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A Garden Full of Gladioli for $2.00

The Gladiolus is one of the most satisfactory flowers grown, and there is no reason why every family cannot enjoy this grand flower—it is as easy to grow as the potato.

Blooms from July to frost if you plant a few bulbs each month from April to July.

For **Two Dollars** we will send **50 Bulbs** of our **Grand Prize** Mixture, which covers every conceivable shade in the Gladiolus kingdom.

Each year we sell thousands of these bulbs and have received numerous testimonials as to their merits.

Order Your Bulbs Now, so as to have them to plant when you begin making your garden.

Simple cultural directions with every package

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Our 1922 Spring Seed Annual sent on request

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Get this valuable Book on Better Lawn Care

Every one interested in the care of large, beautiful lawns should have a copy of this book which tells all about Ideal Power Lawn Mowers. It shows many photos of well-known homes, parks, golf clubs, cemeteries, colleges, etc., where the lawns are cared for the "Ideal Way." It tells about the Ideal Junior, a moderate-priced power mower for medium-sized lawns, the 50-inch Ideal Power Lawn Mower for large lawns, and the Ideal Triplex Power Mower for large parks, golf clubs, etc. Write for this book today—learn how to keep your lawn in better condition at less cost.

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The Refill Shaving Stick

You don't throw your pen away when it needs refilling

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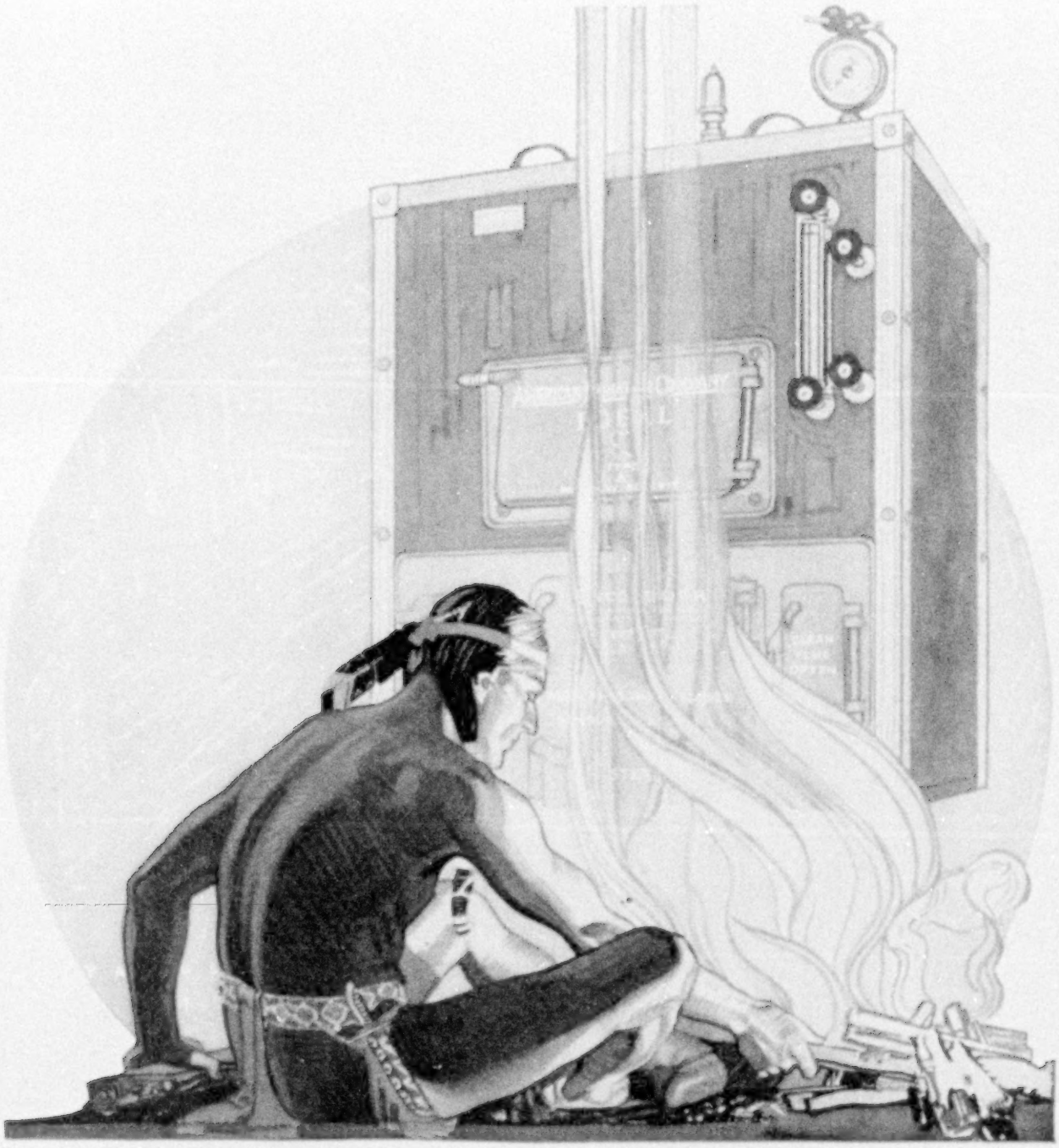

From a painting by HERBERT PAUS. © ARCO. 1922.

MASTERY

To the god of fire the savage bowed down; he worshipped its comfort and dreaded its power.

Each step in man's progress has been marked by an increased mastery over fire. Harnessed to engines it has learned to labor; imprisoned under boilers its destructive heat has been transmitted into health-giving warmth.

In this drama of mastery the Laboratories of the American Radiator Company have played a vital part. Out of them has come a long procession of better boilers, culminating in the IDEAL TYPE A HEAT MACHINE.

By this invention fire is made to work for human comfort more perfectly than fire has ever worked before. The master to whom the savage bowed has been completely mastered.

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Tell me the cost of equipping my building with Chamberlin Metal Weather Strips (check whether home, factory, office building, church, school).

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Save 25%-40% on Coal

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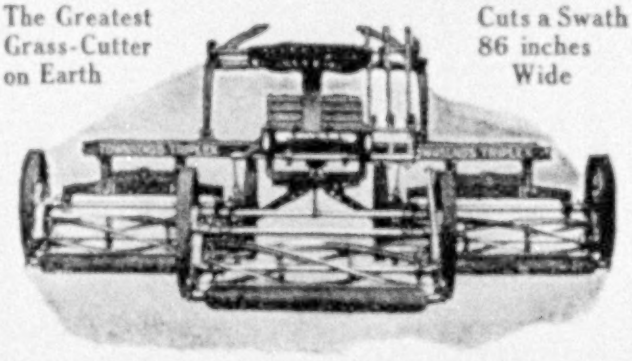
The Greatest Grass-Cutter on Earth

Cuts a Swath 86 inches Wide



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One mower may be climbing a knoll, the second skimming a level, and the third paring a hollow. Drawn by one horse and operated by one man, the TRIPLEX will mow more lawn in a day than the best motor mower ever made; cut it better and at a fraction of the cost.

Drawn by one horse and operated by one man, it will mow more lawn in a day than any three ordinary horse-drawn mowers with three horses and three men.

Does not smash the grass to earth and plaster it in the mud in springtime, neither does it crush the life out of the grass between hot rollers and hard, hot ground in summer, as does the motor mower.

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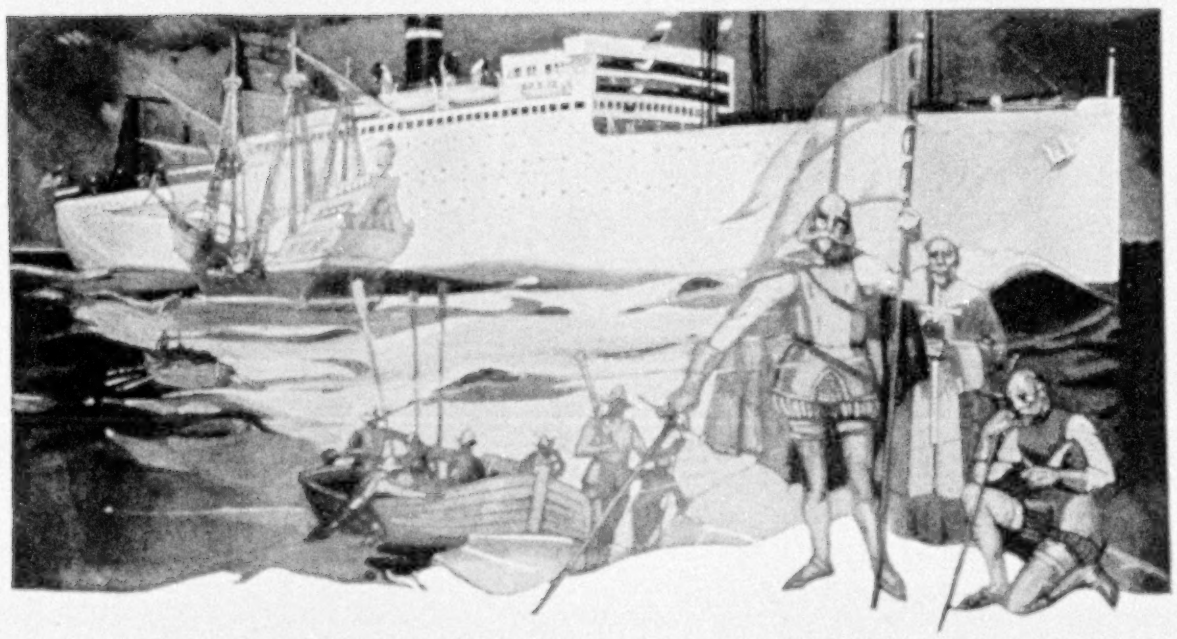
Canton, Ohio

Canadian Agents: Harold F. Ritchie & Co., Ltd., Toronto



Rio De Janeiro Is Now Only 11 Days Away

IF you are planning a trip to the romance lands of South America where centuries ago landed the hardy explorers of Spain and Portugal, send the information blank below and let your Government tell you about the new American ships which take you there with record speed. Rio de Janeiro is now only 11 days away; Montevideo and Buenos Aires but a few days beyond.

A Luxurious Trip

Today you may visit this treasure chest of barely tapped resources in giant and palatial ocean liners, 21,000 ton oil-burners, U. S. Government owned. Operated by the Munson Steamship Lines they derive the benefits of this organization's 50 years of successful experience.

Not until you have traveled on your ships will you know how delightful an ocean voyage can be. Thousands of Americans are going this year. Special tourist arrangements are made for those who wish to visit the interior and return via the West Coast. You should send the information blank and learn more about the new American ships, the new speed, and the new service.

For accommodations address

Munson Steamship Lines

67 Wall Street *New York City*

Next sailings are:

S.S. Southern Cross	*Mar. 16th*
S.S. Aeolus	*Mar. 30th*
S.S. Huron	*Apr. 13th*
S.S. American Legion	*Apr. 27th*

Write for Booklet

Your Government wishes the name of every prospective traveler. If you are considering an ocean voyage anywhere, send the information blank now—no matter when you intend to go. You will receive without cost the Government's booklet of authentic travel information about passports, income tax requirements, etc.; description of U. S. Government ships and literature telling of things to see in foreign lands. You will be under no obligation.

If you yourself cannot take an ocean trip, clip the information blank anyway, and ask some friends who may go to send it in.

U. S. SHIPPING BOARD

Information Desk 1553 **Washington, D. C.**

INFORMATION BLANK
To U. S. Shipping Board
Information Desk **Washington, D. C.**
M 1553

Please send without obligation the U. S. Government Booklet giving travel facts.

I am considering a trip to South America ☐ to Europe ☐ to The Orient ☐. I would travel 1st class ☐ 2nd ☐ 3rd ☐. Going alone ☐ with family ☐ with others ☐. I have definitely decided to go ☐ I am merely considering the possibility of a trip ☐

If I go date will be about _____

My Name _____

My Business or Profession _____

My Address _____

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Open all year. But now—when elements of oppressive weather are absent—is the most desirable time for intelligent rest.

The Signal for the Brakes

Your human machine has its own brakes—automatic, infallible, inexorable. Their tightenings are speed-danger signals.

A little Intelligent Rest, a careful looking over of your human engine, and permanent harm is avoided. Ignore the signals and the brakes lock tight.

Men and women of affairs more and more are heeding these Signals for the Brakes—taking time for Intelligent Rest.

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NATIONAL GEOGRAPHIC SOCIETY

Washington, D. C.

Why the Human Body Grows Old Sooner than Necessary

"There's a Reason"

POOR old Ponce de Leon followed a delusion and found a disappointment.

Metchnikoff was a great scientist. He followed facts and found why the human body grows old sooner than necessary.

He found that food that passes too slowly through the intestines (as many starchy, heavy and "refined" foods do) creates conditions which amount to an ageing of the body.

"Auto-intoxication" is one of the terms used to describe what happens. Hardening of the arteries is one of the results.

Sense Instead of Magic

There is no fountain of eternal youth, of course. But there is an extension of youth, through proper feeding and care of the body.

One of the distinctive qualities of Grape-Nuts as a food is that it helps to avoid the conditions pointed out by Metchnikoff, and by many others since his time, as being the real beginning of old age.

Grape-Nuts has wide popularity because of its delightful taste, its economy and its unusual nourishment—but it has a larger merit than that.

Finding the Life Elements

The processes that make Grape-Nuts—including continuous baking for 20 hours—act upon the nutritive solids, producing a food which is partially pre-digested, and develop in Grape-Nuts its own natural sweetness from the grains.

Whole wheat and malted barley flour—from the grains which are richest of all in the food elements needed by the body—is used in making Grape-Nuts. All the nutriment of the grains is retained, including essential phosphates and other mineral salts, intended by Nature for the building of human bone and brain tissue and for feeding the red corpuscles of the blood.

A Sad Waste Stopped

Often, in making the so-called "refined" or whitened cereal products, these most vital of Nature's gifts are thrown away. Grape-Nuts contains the necessary "roughness" to stimulate quick and complete functioning in the digestive tract.

Grape-Nuts delights the taste with the richness and sweetness of its flavor. Served with milk or cream, it supplies the body with what scientists have found to be an unusually accurate balance of food elements needed for body-building.

Grape-Nuts puts no burden upon the digestion—and it passes naturally through the digestive tract without causing fermentation or creating any of those disturbing conditions which are so common, and which have been identified as a first and principal cause of the ageing of the body.

"There's a Reason"

These are scientific facts about Grape-Nuts

Unhealthy gums denoted by tenderness and bleeding

UNHEALTHY soil kills the best of wheat. Unhealthy gums kill the best of teeth. To keep the teeth sound keep the gums well. Watch for tender and bleeding gums. This is a symptom of Pyorrhea which afflicts four out of five people over forty.

Pyorrhea menaces the body as well as the teeth. Not only do the gums recede and cause the teeth to decay, loosen and fall out, but the infecting Pyorrhea germs lower the body's vitality and cause many serious ills.

To avoid Pyorrhea, visit your dentist frequently for teeth and gum inspection. And use Forhan's For the Gums.

Forhan's For the Gums will prevent Pyorrhea—or check its progress—if used in time and used consistently. Ordinary dentifrices cannot do this. Forhan's will keep the gums firm and healthy, the teeth white and clean. Start using it today. If gum shrinkage has set in, use Forhan's according to directions, and consult a dentist immediately for special treatment.

35c and 60c tubes in U. S. and Canada.

Formula of
R. J. Forhan, D. D. S.
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FOR THE GUMS

SOFT light in the evening is such a comfort! DIM-A-LITES soothe and tranquilize wonderfully.

Then, you want a watch light all night in the front hall, one for each dark hallway or dangerous staircase, and one in the bathroom.

You really need from five to a dozen DIM-A-LITES.

WIRT COMPANY, Philadelphia, Pa.

Next time you see an Electric Shop think of

DIM-A-LITE

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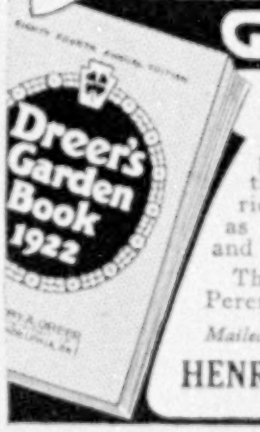
DREER'S 1922 GARDEN BOOK



contains 224 pages, eight splendid color plates, besides numerous photographic true-to-life reproductions. It lists all the standard varieties of Vegetables and Flowers, as well as the best of the novelties, and tells how to grow them.

The newest Roses, Dahlias and Hardy Perennials are given special prominence.

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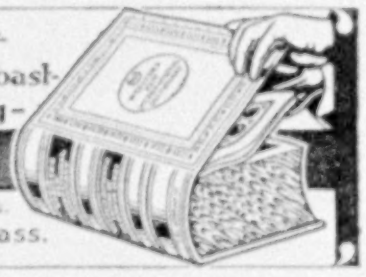

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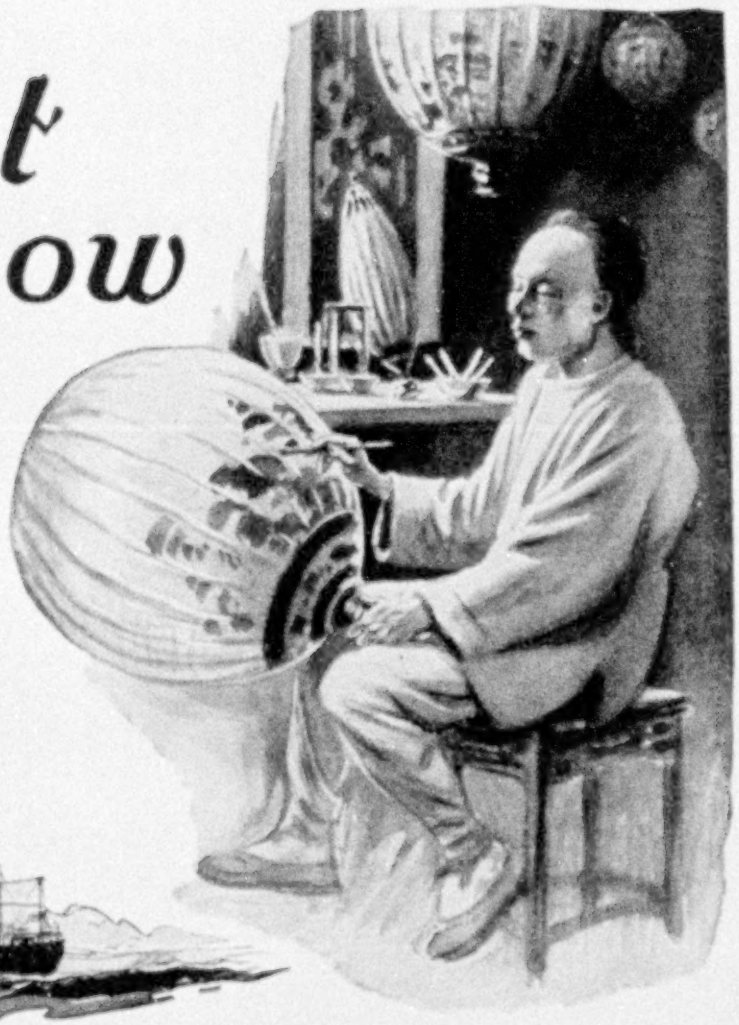
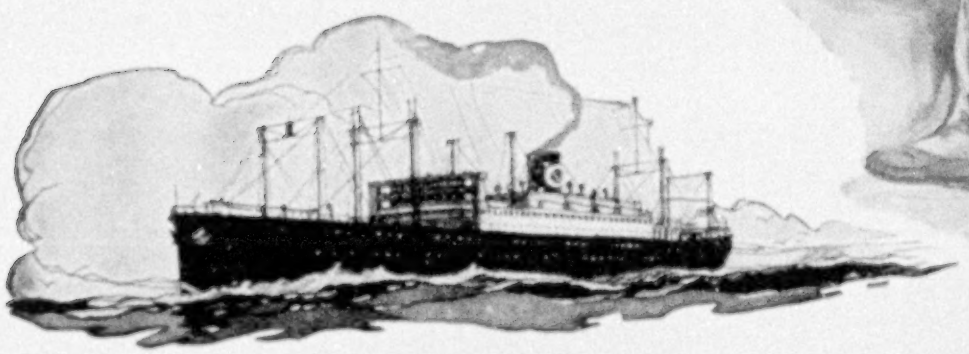
The Orient is nearer now

More comfort and speed on American ships





IF you are planning a trip to The Orient you should know about the new U. S. Government owned ships, which have cut a thousand miles from the journey. They have brought nearer the mysteries, the fascinations, and the sheer beauties of the East. Now in 11 days you can go from Seattle to Yokohama—gateway to wonderful Japan and The Orient.

Luxurious appointments prevail on these great ships — 21,000 ton oil-burners — and they offer all the comforts and facilities of the very best hotel. They are among the finest ships afloat. The service aboard is unexcelled on the seas.

And this year, with the value of the American dollar at its peak, you can *do* more for less than ever before. You should send the information blank below and learn about the opportunity American ships have brought to Americans now.

Write for Booklet

Your Government wishes the name of every prospective traveler. If you are considering an ocean voyage anywhere, send the information blank now. You will receive without cost the Government booklet of authentic travel information and literature telling of things to see in foreign lands. You will be under no obligation.

If you yourself cannot take an ocean trip, clip the information blank anyway and ask a friend who may go to send it in.

For accommodations and sailings, address your local agent or

The Admiral Line

17 State Street, New York City L. C. Smith Bldg., Seattle, Wash.

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Please send without obligation the U. S. Government Booklet giving travel facts.

I am considering a trip to The Orient ☐ to Europe ☐ to South America ☐. I would travel 1st class ☐ 2d ☐ 3d ☐. Going alone ☐ with family ☐ with others ☐.

I have definitely decided to go ☐ I am merely considering the possibility of a trip ☐.

If I go date will be about _____

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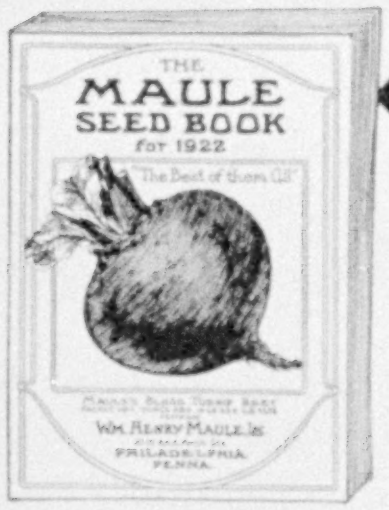

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Why King George Doesn't Like to Live at Windsor Castle

A NEWSPAPER item says King George doesn't like to live at Windsor Castle. He prefers Buckingham Palace, because the plumbing is more up to date.

Modern plumbing is quite different from the plumbing of Queen Elizabeth's time, but in one respect the plumber of today follows the custom of three hundred years ago. In all cases where permanence and real economy are desired, he still uses lead for piping.

Water will run through lead pipes for ages, without causing decay or deterioration. Drainage methods improve, and fixtures become more convenient and more beautiful; but underneath, where real utility is required, lead pipe is still used.

Lead is also the best material for the rain-water drainage system of the house. The picture on this page shows a pipehead on one of the outer walls of Windsor Castle. It was installed, along with gutters, leaders, and spouts, in 1589. For more than three centuries the rains that beat upon this ancient royal residence have been carried off by these lead pipes—and they are still intact.

Today, you will find some of America's finest country homes equipped with gutters, pipe-heads, leader-pipes, copings and flashings of Hoyt Hardlead, which is more enduring than any other metal that can be employed.

Civilized man has found hundreds of other uses for lead and lead products, and of them all the most important is the use of white-lead as the principal ingredient of good paint.

Tons of paint are used, every day, to adorn and preserve the surfaces of buildings. Tons of pure metallic lead are corroded, every day, to produce the white-lead which gives to paint its protective power. "Save the Surface and You Save All" is a slogan which is teaching the world that proper paint-protection means the conservation of millions of dollars yearly in property values.

Most painters prefer to use the paint known as "lead-and-oil," which is simply pure white-lead thinned to paint consistency with pure linseed oil. Paint manufacturers use white-lead as the principal ingredient of the paint they make, and the quality of the paint depends on the amount of white-lead it contains.

National Lead Company makes white-lead of the highest quality, and sells it, mixed with pure linseed oil, under the name and trade mark of

Dutch Boy White-Lead

Write our nearest branch office, Dept. F, for a free copy of our "Wonder Book of Lead," which interestingly describes the hundred-and-one ways in which lead enters into the daily life of everyone.

"Save the surface and you save all"—Hoyt's Hardlead

NATIONAL LEAD COMPANY

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Some Products Made by National Lead Company

Dutch Boy White-Lead	Battery Litharge
Dutch Boy Red-Lead	Battery Red-Lead
Dutch Boy Linseed Oil	Pressure Die Castings
Dutch Boy Flatting Oil	Cinch Expansion Bolts
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Hoyt Hardlead Products for Buildings

XUM

We do not know of one LaFayette owner who has failed to drive his car more than ten thousand miles the first year . . . What better evidence could there be of the charm of LaFayette performance?

LaFAYETTE MOTORS COMPANY at *Mars Hill* INDIANAPOLIS

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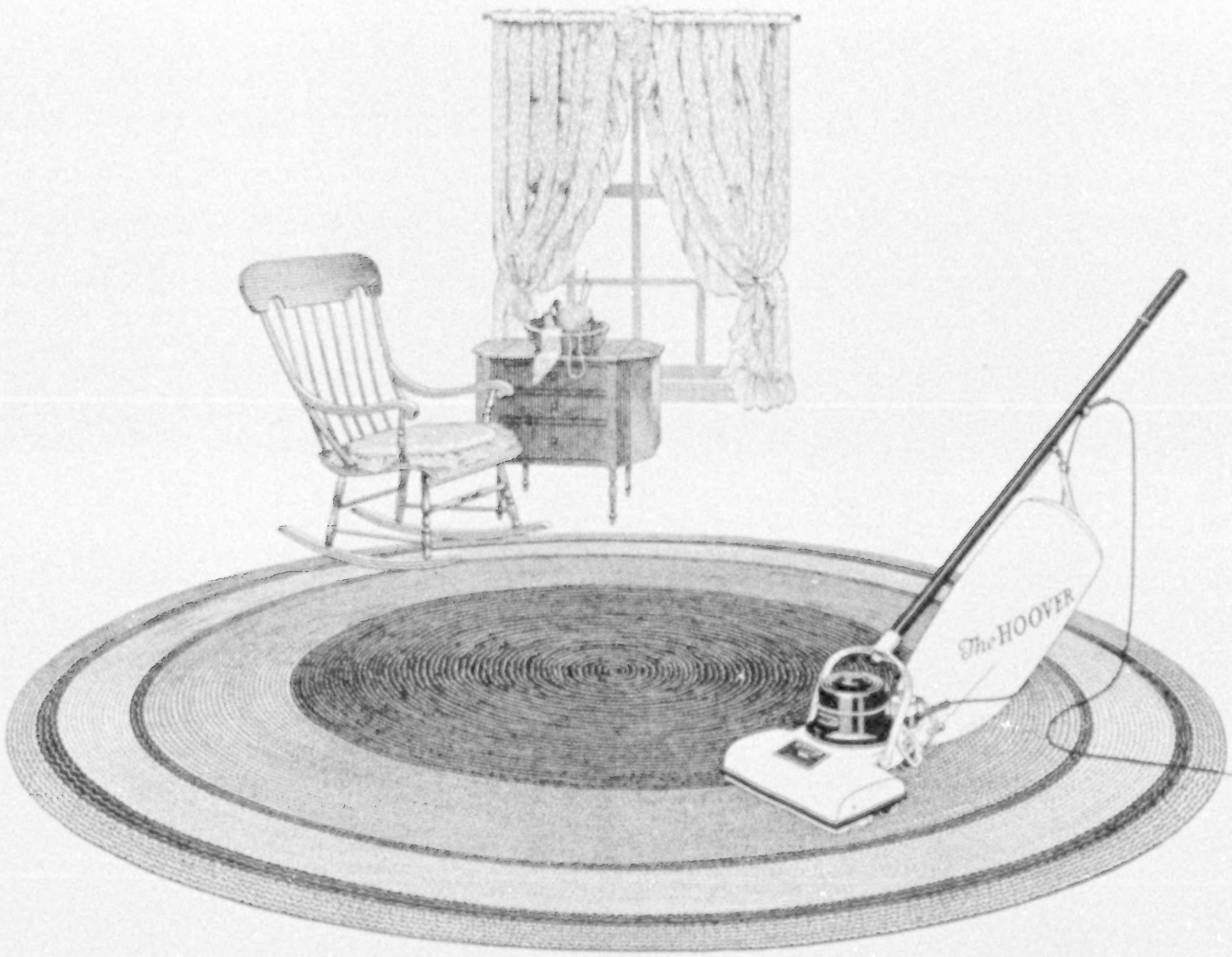

Clean Your Rugs *Clean* at Home

Save yourself the cost and inconvenience of having your rugs taken up and cleaned twice a year. Don't let them remain dirty between times. Get a Hoover and enjoy the pride of ever clean rugs.

Dirt gets into your rugs every day. Much of it sifts in deeply to cling and stay, immune to hand-sweeping. Rapidly it accumulates. Germs swarm in it.

Shoes press the soft rug nap upon this dirt, largely sharp grit. The nap is thus ground off. Your rugs grow threadbare.

The Hoover electrically beats out all such germ-laden, nap-destroying dirt from rug depths. By thus safeguarding health and preserving your rugs from wear, over and over it pays for itself.

In addition, The Hoover electrically sweeps up stubbornest litter, erects crushed nap, freshens colors and cleans by air—in one rapid, dustless operation.

Have an immediate free demonstration in your home of The Hoover and its air-cleaning attachments. Backed by the Guarantee Bond of the oldest and largest makers of electric cleaners, The Hoover is obtainable in four sizes, all moderately priced, on easy terms. Phone any Tel-U-Where Information Bureau or write to us for names of Authorized Dealers.

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